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IN THIS ISSUE

THE record of subsequent mortality among persons with certain physical impairments has indicated a definite risk of excess mortality. The conditions to which this excess mortality is attached are largely the chronic diseases or diseases with a chronic aftermath. In the present article, "Chronic Disease among Middle and Old-Age Persons," Miss Jean Downes of the Fund's staff reports upon the risk of illness and disability for ambulatory persons with chronic disease. The broad indications of the study are that persons with serious chronic disease carry the main burden of illness in the population after age forty is reached. Such cases form a relatively small proportion of the population but are responsible for an excessive amount of sickness and disability. How to lessen the unusual hazard of sickness and disability for the ambulatory person with chronic disease is a pressing health problem.

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The spread of the small family system has been an outstanding corollary of the change from frontier agricultural to urban industrial economy. Some of its effects are discussed by Clyde V. Kiser in an article, "Social Implications of the Under-Developed Family." The discussion is based mainly on recent findings by various investigators. It is chiefly concerned with problems attending the regional and rural-urban imbalance of reproductive levels and with problems inherent in the declining ratios of youth and increasing ratios of aged persons to our total population.

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It has been difficult to educate people, especially in the low-income groups, to seek medical care before they become victims of incapacitating illness. This is perhaps especially true of women with the more common

types of gynecological pathology. In the article entitled: "Gynecological Case-Finding in Maternal Health Clinics," Dr. Regine Stix discusses the types of gynecological pathology found in pelvic examination of women seeking contraceptive advice in two maternal health clinics. The author stresses the importance of the maternal health clinic in reducing maternal morbidity by securing treatment of gynecological disease before it becomes serious.

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The anemia which results from a deficiency of iron is believed to be fairly prevalent during the period of adolescent growth. However, the hemoglobin and erythrocyte values for persons in this age period have been less extensively studied than those for very young children or for adults. In the third paper from a survey conducted in New York City, "Medical Evaluation of Nutritional Status," Miss Dorothy G. Wiehl presents data on hemoglobin and erythrocyte values for "normal" subjects of adolescent ages and discusses the need for better standards at these ages in order to identify persons who have mild or borderline anemia.

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General results from recent and earlier studies for this country have suggested that class differences in the fertility of married women are becoming less pronounced. They have indicated the emergence of exceptions to the traditional inverse order of birth rates along socio-economic lines. The lack of close comparability of the earlier and recent data for this country, however, has permitted only broad and qualitative descriptions of the newer trends in differential fertility. Dr. J. W. Innes' study, "Trends in Class Birth Rates in England and Wales from 1921-1931," is distinctive in that it affords the definitive and quantitative descriptions of recent trends thus far lacking in the studies for this country. His basic data relate to fertility of comparable occupational groups in 1921 and 1931 and were derived from the Registrar General's reports for the two periods.

CHRONIC DISEASE AMONG MIDDLE AND OLD-AGE PERSONS[1]

JEAN DOWNES

THE chronic diseases, chiefly characteristic of middle and old-age persons who are increasing in our population, present a challenge which will increase in force during the next twenty to thirty years. There is need to extend knowledge of these diseases which are now the leading causes of disability and death. A special study of morbidity and particularly the chronic diseases is being conducted among a sample of white families in the Eastern Health District of Baltimore. A preliminary report of certain data of illness observed in the first year's study which ended June, 1939 has been published.[2] This paper presents a more detailed analysis of certain aspects of the problem of chronic disease as observed during that same period of time.

The seriousness of the problem of the chronic diseases characteristic of middle and old age has been judged by their rank as leading causes of death. The amount of and need for institutional and other community facilities for the treatment and care of cases of chronic illness, such as cancer, heart disease, mental disease, and tuberculosis, has been another measure of their importance. Both of these criteria imply an unusual risk of complete incapacity and death for the chronic-disease sufferer. Morbidity surveys have afforded an

[1] From the Division of Public Health Methods of the National Institute of Health and the Milbank Memorial Fund.

Acknowledgments are made:

To the Johns Hopkins School of Hygiene and Public Health, especially to the Departments of Epidemiology, Biostatistics, and Public Health Administration, for generous assistance and cooperation which have greatly facilitated the carrying on of the study of illness in the Eastern Health District of Baltimore.

To the Baltimore City Health Department for generous assistance and cooperation, especially in the matter of relationships with the medical profession.

[2] Downes, Jean and Collins, Selwyn D.: A Study of Illness Among Families in the Eastern Health District of Baltimore. The Milbank Memorial Fund *Quarterly*, January, 1940, xviii, No. 1, pp. 5-26.

additional measure of the extent of the problem, namely, the prevalence of and rate of illness from diseases of a chronic nature. Although it might be inferred that persons suffering from chronic disease contributed greatly to morbidity, as expressed in attacks of illness and amount of disability, it is of interest to determine how much a specific group, such as the ambulatory cases, contributes to the average illness rate for the community. Furthermore, it is of practical importance to study the effect of the presence of chronic disease upon the individual in terms of incapacity and loss of time from usual activities. Since chronic disease is primarily a problem of middle and old age, this analysis is chiefly concerned with illness and disability among persons 40 years of age and older.

When the special study was initiated, the Eastern Health District of Baltimore consisted of two city wards containing 11,896 white families or households, including 43,377 persons, and 3,413 colored households, including 13,784 persons.[8] As far as the white population is concerned, the district is considered fairly representative of the localities in the City in which the wage-earning population live; that is, it contains some families in relatively poor economic circumstances, wage-earning families in moderate circumstances, relatively few families in the professional class, and no families that can be classed as wealthy. Consequently, the district cannot be considered as strictly representative of Baltimore as a whole, but it is probably representative of the population which forms the majority in the City.

There are three hospitals within the Eastern Health District and two adjacent to it. Each of these hospitals has an outpatient department. Approximately 150 private physicians practice regularly within the district. However, during the first year's study some 330 different private physicians served the observed population.

[8] A few months after the special study of illness was started the Eastern Health District was enlarged so that it now includes a population of approximately 100,000. Any reference to the Eastern Health District in this paper, however, is to the former district composed of Wards 6 and 7.

Data and Method of Study

The method of sampling in this particular study has been described in detail in a previous report.[2] It is sufficient here to say that the white families living in thirty-five city blocks formed the sample population. The plan of the study was to follow families that live in a group of houses in certain blocks rather than to follow a selected group of families. No attempt was made to continue visiting families that moved out of these houses during the period of the study, but the new families that moved into the houses vacated in the sample blocks were included in the study. It was considered important to secure illness records from the families at fairly frequent intervals. Past experience had led to the belief that monthly visits would yield more accurate reports of illness than would visits at longer intervals of time and that with this plan fewer of the minor cases of sickness would be missed. Consequently, monthly visiting was initiated in this study. The record of illness started with the first visit to the family; no attempt was made to secure a report of illnesses which had occurred during a period preceding the first visit except illness existing on the day of the visit.

In the studies of illness conducted by periodic canvasses of families, "illness" may be considered to include any affection or disturbance of health which persists for a considerable part of one or more days. In this study, as in other family surveys, no definition of illness is imposed or set up from without the study. The records of "illness" obtained in this study are of sicknesses reported by the household informant (usually the housewife), either as experienced by herself or as she observed them in her family. Physical defects or deformities, even though disabling, were excluded from this analysis. Illnesses present in the family at the time of the first visit were recorded but in this analysis are not considered as illnesses occurring within the period of the study.

The problem of obtaining a more accurate and complete picture

[2] *Op. cit.*

of the extent of chronic disease or affections in an observed population has been one of the particular concerns of the study in the Eastern Health District. At the time of the first visit to the family a special effort was made to record all diseases of a chronic nature among the present members of each household, whether or not they were causing present disability. Careful inquiry was made also concerning members of the family at that time resident in institutions for the insane, for the feeble-minded, for the tuberculous, and for other chronic diseases requiring institutional care.[4]

Special information was sought for all diseases of a chronic nature. This special information included data concerning the onset of the first symptoms of the disease, their nature and date; the date first diagnosed, and whether or not the diagnosis was made by a private physician, at a clinic or at a hospital. Also, for each chronic disease present, data were secured concerning disabling attacks which occurred previous to the time of the special study of illness. Such a record has made it possible to observe the occurrence of new cases of chronic disease which were manifest by illness sufficiently severe to obtain a diagnosis.

For all cases of illness a record was made of the nature of medical service received and whether rendered by a private physician, clinic, or hospital. The causes of illness as reported by the family informants were submitted to the attending physicians for confirmation or correction. The causes of illness for clinic attendance and hospital admissions were also checked against the records of the clinic or hospital where the service was given.

Illness Among Cases of Chronic Disease

Cases of chronic disease in a population during a given period of time may be divided into three groups. These are cases in institutions, bed cases cared for in the home, and ambulatory cases with

[4] These records are considered as reasonably complete because for each family information was secured concerning all nonresident children of the head of the household; thus, those in institutions were recorded along with others not living at home.

varying periods of disability or no disability. The particular purpose of this study is to present the record of sickness over a period of time for the ambulatory cases of certain of the more serious chronic diseases. Since it is preferable to have a uniform period of observation for all ambulatory cases, the study will be limited to the experience of cases present in 1,243 families observed through twelve consecutive months.[8]

The sample population was found to be representative of the white population of the district from which it was drawn with respect to age constitution and size of household. The age distribution of the population in the 1,243 families compared with the age distribution of the total white population of the Eastern Health District is shown in Table 1. It is apparent that there are no important differences between the sample population and the total white population with respect to age content. The average size of white households in that year for the total district was 3.6 persons per household, compared with 4.0 persons per household in the sample population.

Persons with Chronic Disease. It is necessary to define what is meant by chronic disease. The term "chronic" disease usually includes those diseases or affections which have as a common characteristic a relatively long duration in time, in contrast to the term "acute" which denotes short duration. In this study the diseases or affections of a chronic nature which have been selected for special study are as follows: *heart disease, hypertension* or *high blood pressure, arthritis* or *rheumatism, tuberculosis, diabetes, chronic nephritis, pernicious anemia, gallbladder disease, ulcer of the stomach* or

[8] The previous report upon the study of illness in the Eastern Health District included 1,796 families observed two months or longer. It was pointed out that there were 492 families included in this total which were classified as "moving families"; that is, they either moved into or out of the study area during the year. An additional sixty-one families were dropped from the study during the first year because they did not wish to continue to be visited. The average period of observation for these moving and dropped families was six months. Since in the present analysis it is preferable to have as nearly as possible a uniform period of observation for all ambulatory cases if the full effect of chronic disease upon them is to be considered, the families observed less than a year have been excluded.

Age	Sample Population (White Families)	Total White Population in Eastern Health District 1939	Sample Population (White Families)	Total White Population in Eastern Health District 1939[1]
	per cent		number	
All Ages	100.0	100.0	4,998	43,377
0–4	7.1	6.5	353	2,833
5–9	6.8	6.8	342	2,965
10–14	8.7	8.5	435	3,666
15–19	9.7	9.9	486	4,272
20–24	9.0	10.2	446	4,419
25–29	8.7	9.4	436	4,088
30–34	8.8	8.2	439	3,573
35–44	14.7	14.3	735	6,164
45–54	12.7	12.7	635	5,508
55–64	7.8	7.7	391	3,314
65+	6.0	5.8	300	2,519
Unknown Age				56

[1] Obtained from preliminary tabulations of unpublished data collected and analyzed by the Department of Biostatistics of the Johns Hopkins School of Hygiene and Public Health with the assistance of the Baltimore City Health Department.

Table 1. Age distribution of the sample population in thirty-five blocks in the Eastern Health District of Baltimore, compared with the total white population in the district.

duodenum, hernia, varicose veins, prostatitis, rheumatic fever and *rheumatic heart disease, cancer, syphilis,* and *mental disease.*

During a given interval of time individuals in the population may be divided with respect to illness into three classes: (1) those who reported no illness; (2) those reporting the presence of chronic disease, and (3) those who experienced one or more illness of an acute nature only.[6] As a background for the discussion of the ambulatory cases of chronic disease, it is of interest to present a picture of the total population with respect to the three classes noted above.

Figure 1 shows for males and females, respectively, the proportion of the total population which each of these classes formed at various ages. It is apparent that the percentage of persons of both

[6] Chronic conditions such as chronic bronchitis, asthma, and hay fever have not been considered among the selected chronic diseases. Attacks of these illnesses have been included among those of an acute nature.

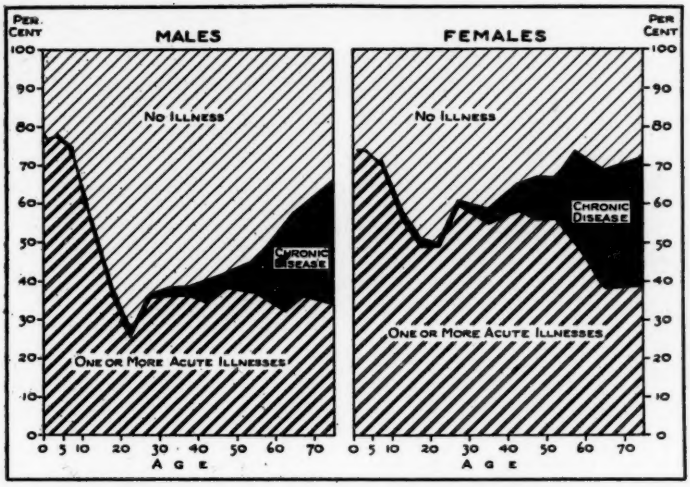


Fig. 1. Proportion of the total population by sex who (1) reported no illness, (2) reported the presence of chronic disease, and (3) those who reported only one or more acute illnesses in 1,243 canvassed white families. Eastern Health District of Baltimore, 1938-1939.

sexes reporting some illness during twelve consecutive months is relatively high at the two extremes of life, at the very young ages and in old age. Conversely, the proportion of persons reporting no illness is highest in young adult life and lowest among the very young and the old. It is apparent also that chronic disease is present among persons of both sexes under 20 years of age and that disease of a chronic nature plays an increasingly important part in the proportions sick after age 30 is reached. Among persons 60 years of age or older, from 40 to 50 per cent of those reporting illness have chronic disease.

The increase of chronic disease with age is brought out more clearly for each sex in Figure 2 which shows the proportion of persons with chronic disease among the total population. Under 10 years of age approximately 1 per cent had chronic disease. At ages 10 to 29 the proportion with chronic disease in both sex groups

varied from less than 1 per cent to 2 per cent. After age 30, both among males and females, the proportions with chronic disease increased in each succeeding decade, with the sharpest increases after age 40. In other words, the increase for both sexes was greatest during middle and old age. From age 40 to age 69 a higher proportion of females than males reported the presence of chronic disease. At age 70 and over, 31 per cent of each sex group were chronic-disease patients.

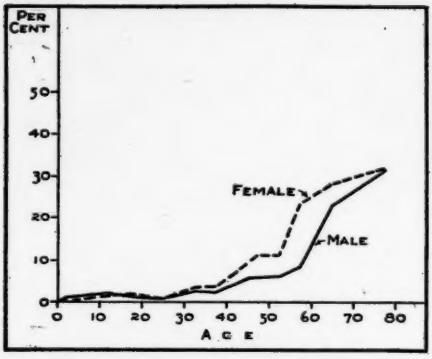


Fig. 2. Proportion of the total males and females who reported the presence of chronic disease in 1,243 canvassed white families. Eastern Health District of Baltimore, 1938-1939.

Since the more serious chronic diseases are more frequent in the middle and old-age period of life, the remainder of the discussion of the problem in this paper will be confined to the population 40 years of age and older. In this group there were 86 males and 153 females who reported the presence of chronic disease at the beginning of the year's study and were ambulatory at the time. The chronic diseases or affections included were as follows: heart disease, hypertension, arthritis, diabetes, chronic nephritis, ulcer of the stomach or duodenum, hernia, gallbladder disease, varicose veins, pernicious anemia, prostatitis, Parkinson's disease, and syphilis.[7]

Table 2 shows for each case the duration of the disease from the

[7] Cases of active tuberculosis are usually nonambulatory. Experience in this and other studies has shown that probably cancer is incompletely reported as an illness and when reported the cases were generally bed cases. Consequently, these two diseases were excluded from the following analysis. In addition, cases of mental disease cared for in the home and all cases of chronic disease confined to bed or hospital throughout the period of observation were nonambulatory and were excluded.

It is recognized that syphilis is incompletely reported as illness; however, those cases that were reported have been included.

time the first diagnosis was made to the beginning of observation in the morbidity study. It will be noted that for some of the chronic

Table 2. Duration of cases of chronic disease from diagnosis to the beginning of the morbidity study. Eastern Health District of Baltimore, 1938-1939.[1]

Type of Chronic Disease and Sex	Total Persons	Duration of Disease from Diagnosis to First Observation						
		Less Than 1 Year	1–1.9 Years	2–2.9 Years	3–3.9 Years	4–4.9 Years	5 Years or Longer	Unknown
Total Males	86	14	7	9	9	4	39	4
Total Females	153	21	16	15	12	11	63	15
Heart Disease								
Males	16	2	2	2	1	0	8	1
Females	30	2	5	3	2	2	11	5
Hypertension								
Males	16	3	2	3	2	1	5	0
Females	45	8	6	6	2	3	16	4
Arthritis								
Males	17	3	0	1	1	2	10	0
Females	29	4	3	4	4	0	10	4
Diabetes								
Males	4	3	1	0	0	0	0	0
Females	20	5	1	0	2	3	9	0
Nephritis								
Males	8	2	0	1	0	0	4	1
Females	6	1	0	0	0	1	4	0
Ulcer of Stomach or Duodenum								
Males	4	0	0	0	3	0	1	0
Hernia								
Males	12	0	0	1	1	0	10	0
Females	2	0	0	0	0	0	1	1
Gallbladder Disease								
Females	11	1	1	0	1	2	5	1
Varicose Veins								
Females	8	0	0	2	1	0	5	0
Pernicious Anemia								
Males	1	0	0	0	0	0	1	0
Females	2	0	0	0	0	0	2	0
Prostatitis								
Males	3	0	2	1	0	0	0	0
Parkinson's Disease								
Males	1	0	0	0	1	0	0	0
Syphilis								
Males	4	1	0	0	0	1	0	2

[1] Based on persons 40 years of age and older.

diseases the number of cases was very small. Heart disease, hypertension, arthritis, and diabetes were the most frequent. About 40 per cent of these cases had been diagnosed five or more years before

Table 3. Cases of chronic disease classified according to type of disease and by whom the diagnosis was made. Eastern Health District of Baltimore, 1938-1939.[1]

Type of Chronic Disease and Sex	Total Persons	Chronic Disease Diagnosed By:		
		Private Physician	Physician at Hospital Clinic	Unknown
Total Males	86	62	13	11
Total Females	153	106	29	18
Heart Disease				
Males	16	12	2	2
Females	30	24	2	4
Hypertension				
Males	16	14	0	2
Females	45	33	9	3
Arthritis				
Males	17	13	2	2
Females	29	18	4	7
Diabetes				
Males	4	2	2	0
Females	20	15	5	0
Nephritis				
Males	8	7	1	0
Females	6	3	3	0
Ulcer of Stomach or Duodenum				
Males	4	1	2	1
Hernia				
Males	12	8	0	4
Females	2	0	2	0
Gallbladder Disease				
Females	11	7	3	1
Varicose Veins				
Females	8	4	1	3
Pernicious Anemia				
Males	1	0	1	0
Females	2	2	0	0
Prostatitis				
Males	3	1	2	0
Parkinson's Disease				
Males	1	1	0	0
Syphilis				
Males	4	3	1	0

[1] Based on persons 40 years of age and older.

the beginning of observation and approximately 17 per cent had been diagnosed within a year previous to the period of special study. Slightly more than 50 per cent of the remaining cases of chronic disease had been diagnosed five years or more before the special study and less than 10 per cent had their onset and diagnosis within a year before the beginning of observation.[8]

Table 3 shows for the same groups of cases, whether the diagnosis was made by a private physician or by a physician at a hospital clinic or dispensary. It is apparent that the majority of these cases of chronic disease had been diagnosed by a physician. The category "unknown" may contain some cases of self-diagnosis, but in most instances cases had to be classified as unknown because the informant was not always the individual with the chronic disease and lacked information as to who made the diagnosis.

Illness Among Ambulatory Persons With Chronic Disease. It is of interest to investigate whether ambulatory persons with chronic disease are more liable to illness other than the chronic disease from which they suffer than persons of similar age in the "nonchronic" population. Since the number of persons with a specific chronic disease was few, the annual amount of illness among the group as a whole is presented. There were almost twice as many females as males with chronic disease and for this reason the sex groups are dealt with separately.

Table 4 shows the annual incidence of illness among the 86 males and the 153 females who constitute the chronic-disease population, compared with the incidence of illness among persons with no chronic disease. In this analysis the chronic disease which the ambulatory patient has is not counted as an illness. Acute manifestations or attacks of chronic disease suffered by the 86 males and the

[8] Each individual with chronic disease was counted once only, though he may have had more than one chronic disease. For example, the diabetic case may have had arthritis as well as diabetes, or in another diabetic there may have been evidence of some breakdown of the circulatory system. In both instances the case was counted as one of diabetes, since from the history the presence of diabetes antedated either of the other conditions.

153 females are also excluded from the total number of attacks of illness shown in this table. The annual rate from all causes of illness was 1,197 per 1,000 among the 86 males, contrasted with the rate of 674 per 1,000 among the 726 males with no known chronic disease. The ratio of the illness rate among chronic-disease sufferers to the rate among the rest of the male population was 1.77, or 77 per cent higher. Excess illness rates were noted for the chief causes of illness, namely, the respiratory diseases and accidents. For respiratory diseases, accidents, and all other causes of illness, the ratios of the rate in the chronic-disease population to that in the "nonchronic" population were 1.20, 1.36, and 2.56, respectively.

A comparison of the illness rate among the 153 females with chronic disease with the 715 females with no chronic disease in the

Table 4. Annual incidence of illness of a nonchronic nature among ambulatory persons with chronic disease when first observed and among persons with no chronic disease when first observed. Eastern Health District of Baltimore, 1938-1939.[1]

Causes of Illness	86 Males With Chronic Disease at First Observation	726 Males With No Chronic Disease at First Observation	153 Females With Chronic Disease at First Observation	715 Females With No Chronic Disease at First Observation	Ratio of the Rate Among Persons With Chronic Disease to that Among Those With No Chronic Disease	
					Males	Females
	Rate per 1,000 population					
All Causes of Illness[2]	1,197	674	1,745	1,242	1.77	1.40
Respiratory Diseases	384	320	719	534	1.20	1.35
Accidental Injuries	105	77	144	124	1.36	1.16
All Other Illness	709	277	882	584	2.56	1.51
	Number of cases of illness					
All Causes of Illness	103	489	267	888		
Respiratory Diseases	33	232	110	382		
Accidental Injuries	9	56	22	89		
All Other Illness	61	201	135	417		

[1] Based on persons 40 years of age and older.
[2] Acute manifestations of chronic disease suffered by the chronic-disease population, the 86 males and the 153 females, are excluded from the total number of attacks of illness.

Age	Rate per 1,000 Population		Number of Illnesses		Number of Persons	
	Male	Female	Male	Female	Male	Female
40–44	619	1,396	112	229	181	164
45–49	603	1,315	91	196	151	149
50–54	693	1,265	104	172	150	136
55–59	771	1,411	74	127	96	90
60–69	724	963	76	103	105	107
70 and Over	744	884	32	61	43	69

Table 5. Annual incidence of illness at specific ages for males and females with no chronic disease when first observed for illness. Eastern Health District of Baltimore, 1938-1939.

middle-age and old-age group showed differences generally similar to those noted among males. The ratios of the rates in the chronic-disease group to those in the "nonchronic" population were as follows: all causes of illness, 1.40; respiratory diseases, 1.35; accidental injuries, 1.16; and all other illnesses, 1.51.

Even though these data are based upon very small numbers, the consistency in the results for both males and females leads to the conclusion that ambulatory cases of chronic disease in the middle and old-age group suffer a greater frequency of illness than do persons at the same ages who do not have chronic disease.

That the differences in the incidence of illness in the two groups are not due to an unusual number of the aged in the chronic-disease group is shown by Tables 5 and 6. Table 5 shows the age-specific illness rates for the population composed of persons without known chronic disease. When these rates are applied to the population with chronic disease, as shown in Table 6, the expected number of illnesses among males was 61 compared with the observed number of 103, or an excess of observed over expected of 69 per cent. Among females, the expected number was 174 compared with the 267 observed illnesses, or an excess of 53 per cent. Obviously, age was not a determining factor in the higher incidence of illness suffered by the chronic-disease population.

Had acute manifestations of the particular chronic disease suf-

Age	Illnesses Among Males		Illnesses Among Females		Number of Males	Number of Females
	Observed	Expected	Observed	Expected		
All Ages	103	60.7	267	174.1	86	153
40–44	21	7.4	16	18.1	12	13
45–49	4	3.6	44	23.7	6	18
50–54	10	5.5	31	21.5	8	17
55–59	9	6.9	59	39.5	9	28
60–69	33	23.2	79	40.4	32	42
70 and Over	26	14.1	38	30.9	19	35

Table 6. Observed number of illnesses other than chronic, by sex, in a population composed of persons who had a chronic disease when first observed, contrasted with the expected number of illnesses in the same population if the rate for persons with no chronic disease is applied to this population. Eastern Health District of Baltimore, 1938-1939.

fered by the patient been included in the total attacks of illness for the chronic-disease population, the differences in the illness rates would have been even greater. There were 27 such attacks of illness among the 86 males and 77 attacks among the 153 females.[9]

Disability Among Ambulatory Chronic-Disease Patients

In the study of morbidity, one measure of the severity of an illness is the amount of disability it causes. Does the presence of chronic disease impose a greater risk of disabling illness upon the ambulatory patient than is the risk of disabling illness for the general population? The answer is obviously in the affirmative. But the extent of this risk is of considerable interest. Table 7 shows the disabled days, bed days, and hospital days per person for the individuals with chronic disease observed during twelve consecutive

[9] By acute manifestations of chronic disease is meant attacks of illness attributed solely to the chronic disease from which the patient suffered and which were sufficiently severe to cause disability and usually to require medical attendance. The patient may have reported these acute illnesses in terms of symptoms, but if the attending physician checked the particular attack as due to the chronic disease which the patient had, it was classed as an acute manifestation of the chronic disease. For example, a patient with chronic heart disease may report a disabling attack of indigestion or of abdominal and chest pain. If the physician checks this attack as one of heart disease, it was considered in this study as an acute manifestation of chronic heart disease. The only rule for counting these acute manifestations as attacks was that there must have been an interval of at least ten to fourteen days between attacks, during which time the patient was able to be up and engaged in his usual activities.

months, compared with the average for those with no chronic disease observed during the same period. These data for the chronic-disease population include all disabled days, whether caused by the chronic disease itself or by attacks of illness of a nonchronic nature. The males with chronic disease, but who were ambulatory cases, had 30 disabled days, 13.8 bed days, and 6 hospital days per person per year. This was from nine to ten times the amount of disability, expressed in days, suffered by the "nonchronic" male population, where the days per person were: disabled 3, bed 1, and less than 1 hospital day per year.

The females with chronic disease had an average of 34 disabled days per person per year; bed days averaged approximately 8 per person and hospital days 3 per person per year. This was from six to seven times the average amount of disability recorded for females with no chronic disease, among whom there were 5 disabled days, 1 bed day, and less than 1 hospital day per person per year.

Severity of Disabling Attacks of Illness. It is of interest to know whether attacks of illness of a nonchronic nature were more severe among persons with chronic disease than was true for the "nonchronic" population. This may be shown by presenting disabled

Table 7. Annual days of disability among persons with chronic disease and among those with no chronic disease. Eastern Health District of Baltimore, 1938-1939.[1]

Population, Class and Sex	Annual Days per Person Observed			Number of Days			Number of Persons
	Disabled Days	Bed Days	Hospital Days	Disabled Days	Bed Days	Hospital Days	
Persons with Chronic Disease							
Males	30.4	13.8	6.2	2,611	1,186	535	86
Females	34.4	7.8	2.8	5,257	1,201	431	153
Persons with No Chronic Disease							
Males	3.4	1.3	0.7	2,412	949	479	704
Females	5.5	1.3	0.4	3,781	918	278	682

[1] Based on persons 40 years of age and older.

days, bed days, and hospital days in relation to disabling attacks of illness. During the course of the year's study new cases of chronic disease were diagnosed in the population under observation. There were thirty-two of these cases among males and forty-two among females 40 years of age or older. In a consideration of disabling attacks of illness within the year studied these individuals may be added to the chronic-disease population.

Table 8 shows the disabled days, bed days, and hospital days per disabling attack for the population 40 years of age and over with chronic disease and for those with no chronic disease. Disabling attacks of illness for the chronic-disease population are shown according to attacks which were acute manifestations of the particular chronic disease from which the individual was suffering and attacks of illness of a nonchronic nature.

Among males with chronic disease there were 48 disabled days, 17 bed days, and 7 hospital days per disabling attack of all disabling illness. These rates were approximately twice as high as for the rest of the male population where the disabled days, bed days, and hospital days per disabling attack were 18, 7, and 4, respectively. However, when disabling attacks of illness of a nonchronic nature among the chronic-disease population are considered there is very little difference in the two population groups in the amount of disability per disabling attack.

Females with chronic disease had on the average 30 disabled days, approximately 7 bed days, and 2 hospital days per disabling attack of all disabling illness. This was approximately twice the disability per disabling attack suffered by the females in the population with no chronic disease where there were 14 disabled days, approximately 4 bed days, and 1 hospital day per disabling attack of illness. Disabling attacks of illness of a nonchronic nature among females with chronic disease were fairly similar to those for the "nonchronic-disease" population in respect to disabled days, bed days, and hospital days per disabling attack.

From these data there is no evidence that the presence of chronic disease in individuals causes disabling attacks of illness of a nonchronic nature suffered by them to be more severe when severity is measured in terms of disabling days, bed days, and hospital days per disabling attack. However, the data presented in this study are small in number and represent the average experience of persons with chronic diseases which in themselves vary widely in severity. The results can be interpreted only as suggestive. Larger groups of ambulatory patients with the various chronic diseases are needed for study so that those with specific diseases can be dealt with separately.

Table 8 does indicate the important part that disabling attacks

Table 8. Disabled days, bed days, and hospital days per disabling attack of illness among ambulatory chronic-disease patients and among persons with no chronic disease. Eastern Health District of Baltimore, 1938-1939.[1]

Class	Number of Attacks of Illness Causing Disability	Days per Disabling Attack			Number		
		Disabled Days	Bed Days	Hospital Days	Disabled Days	Bed Days	Hospital Days
Ambulatory Cases of Certain Chronic Diseases							
118 Males							
Disabling Illness	92	48.0	16.7	7.0	4,412	1,537	642
Chronic[2]	51	69.4	25.0	10.7	3,537	1,276	548
Nonchronic	41	21.3	6.4	2.5	875	261	104
195 Females							
Disabling Illness	229	30.1	6.6	1.9	6,898	1,512	436
Chronic[2]	110	38.6	8.5	2.8	4,241	933	306
Nonchronic	119	22.5	4.9	1.1	2,657	579	130
Persons Reporting One or More Illnesses of a Nonchronic Nature							
276 Males	132	18.3	7.2	3.6	2,412	949	479
412 Females	262	14.4	3.5	1.1	3,781	918	278

[1] Based on persons 40 years of age and older.
[2] Disabling illnesses from chronic disease are acute manifestations of the particular chronic disease from which the individual was suffering.
Disabling illnesses from the minor chronic diseases are treated identically in all population groups.

of chronic disease play in the amount of disability suffered by the ambulatory case. Among males there were 69 disabled days, 25 bed days, and 11 hospital days per disabling attack of chronic disease. Among females there were 38 disabled days, 8 bed days, and 3 hospital days per disabling attack. On the whole, disabling attacks of chronic disease were more severe among males than among females when severity is measured in the terms indicated above. This is of interest in the light of the fact that mortality at these ages among males is higher than among females; yet illness occurs more frequently among females than among males.

The influence of the ambulatory case of chronic disease on the amount of disability suffered by the population 40 years of age and older is summarized in Table 9. Males who were ambulatory cases of chronic disease formed approximately 15 per cent of the total male population in the middle and old-age group. They were responsible for 65 per cent of the total disabled days, 62 per cent of the bed days, and 57 per cent of the hospital days suffered by the middle and old aged during the twelve consecutive months studied. Females who were ambulatory cases of chronic disease formed 22 per cent of the total females 40 years of age and older. They were responsible for 62 per cent of the disabled and bed days and 61 per

Table 9. Proportion of population and of disabled days contributed by ambulatory persons with certain chronic diseases during twelve consecutive months. Eastern Health District of Baltimore, 1938-1939.[1]

Type of Disability	Per Cent Persons With Chronic Disease Formed of Total		Number With Chronic Disease		Total Population	
	Males	Females	Males	Females	Males	Females
Population	14.5	22.2	118	195	812	878
Disabled Days	64.7	62.2	4,412	6,898	6,824	11,086
Bed Days	61.8	62.2	1,537	1,512	2,486	2,430
Hospital Days	57.3	61.1	642	436	1,121	714

[1] Based on persons 40 years of age and older.

cent of the hospital days of illness suffered by the total female population during the year studied.

Effect of Ambulatory and Nonambulatory Cases of Chronic Disease. To show the full effect of chronic disease in terms of disabled days in the population 40 years of age and older, it is necessary to include also the nonambulatory cases of the chronic diseases referred to on page 12; that is, cases of cancer, active tuberculosis, other bed cases, and all institutional cases which have been excluded from comparisons of ambulatory and nonchronic persons. Table 10 shows for males and females combined the proportion of the total disabled days, bed days, and hospital days which were due (1) to ambulatory cases; (2) to nonambulatory cases of chronic disease; and (3) to persons with no chronic disease. Persons with no chronic disease formed 80 per cent of the population and were responsible for approximately one-fourth of the disabled days, 21 per cent of the bed days, and 17 per cent of the hospital days recorded during the year. On the other hand, nonambulatory cases

Table 10. Proportion of disabled days contributed by ambulatory cases of chronic disease, nonambulatory cases and persons with no chronic disease during twelve consecutive months. Eastern Health District of Baltimore, 1938-1939.[1]

Classification of Persons	Per Cent				Number			
	Disabled Days	Bed Days	Hospital Days	Population	Disabled Days	Bed Days	Hospital Days	Population
Total	100.0	100.0	100.0	100.0	23,832	8,892	4,536	1,727
Ambulatory Chronic Cases	47.5	34.3	26.0	18.1	11,310	3,049	1,178	312
Nonambulatory Chronic Cases[2]	24.8	44.7	57.3	1.7	5,922	3,976	2,601	29
Persons with No Known Chronic Disease	27.7	21.0	16.7	80.2	6,600	1,867	757	1,386

[1] Based on persons 40 years of age and older.
[2] Nonambulatory chronic cases include all institutional cases, all cases of active tuberculosis, cancer, and cases of other chronic diseases confined to bed throughout the year.

of chronic disease constituted only about 2 per cent of the population and were also responsible for one-fourth of the disabled days, 45 per cent of the bed days, and 57 per cent of the hospital days for the total year. Ambulatory cases of chronic disease formed 18 per cent of the population and were responsible for 47 per cent of the total disabled days, 34 per cent of the bed days, and approximately one-fourth of the total hospital days.

Distribution of Individuals With Chronic Disease Among Employed Middle and Old-Age Persons and Among Families

There was a total of 812 male persons in the population 40 years of age or older; 628 of these were employed during the year of study. The majority of the employed were in the age group 40-59; only 100 of them being 60 years of age or older. In the middle-aged group, forty individuals, or approximately 8 per cent of the employed, were ambulatory cases of chronic disease; in the old-age group, those employed at ages 60 or over, twenty-seven of the total of 100 were ambulatory cases of chronic disease. When the average annual amount of disability suffered by these chronic-disease patients shown in the previous discussion is recalled, its social implications in relation to employment may be inferred.

It is also of interest to know how many families are affected by the presence of the more serious chronic diseases, nonambulatory and ambulatory cases of all ages, among their members. Among the 1,243 families observed twelve months there were 251 families, or 20 per cent of the total, in which there was one case of chronic disease. In an additional 64 families, or 5 per cent of the total, there were two or more cases of chronic disease. This means that chronic disease was present in 25 per cent of the total families studied.

In brief summary, the data presented in this paper have indicated that persons with serious chronic disease carry the main burden of

illness in the population after age 40 is reached. Ambulatory cases not only had a higher frequency of attacks of illness but also suffered an excessive amount of disability in comparison with disability from illness in the "nonchronic" population. They formed only 18 per cent of the total population and may indeed be characterized as a sickly group. In conclusion, the illness experience of the ambulatory cases of chronic disease suggests that preventive medicine may in the future play an important supplementary role in methods of treatment. Specific therapeutic measures, which do not help to increase the patient's resistance to intercurrent infections, will be considered insufficient.

SOCIAL IMPLICATIONS OF THE UNDER-DEVELOPED FAMILY

CLYDE V. KISER[1]

THE decline of the large family has gone hand in hand with increasing urbanization. Now that almost two-thirds of our population reside in towns and cities, where small families predominate, the social implications of the under-developed family become increasingly important.

With respect to size, we may for present purposes regard as "under-developed" families contributing fewer than three children. Simple as this definition seems, the complexity of the problem becomes apparent when it is desired to ascertain from direct sources what proportion of families would be classified as under-developed at the present time. It would obviously be erroneous to regard as "under-developed" all families having fewer than three *resident* children. Among such families would be young couples just beginning their marriage, elderly couples whose children had migrated from home, and couples of all ages who had lost one child or more through death. These difficulties indicate the necessity of relating the problem to total number of children ever born among couples of completed fertility. The trouble with this, however, is that such data reflect fertility levels of the past rather than those of today. This inadequacy is lessened by restriction of the analysis to married women who have just completed the childbearing period, but for recent comprehensive data we must await tabulations from the 1940 Census.[2]

[1] From the Milbank Memorial Fund. This paper was presented in substantially its present form at The New England Conference on Tomorrow's Children, held in Cambridge, July 24-26, 1940, under the auspices of The Harvard Summer School and the National Conference on Family Relations.

[2] In 1940, for the first time since 1910, the Bureau of the Census collected data concerning total number of children ever born. This was done for a 5 per cent random sample through the use of a supplementary questionnaire. From these, tabulations are possible concerning the number of children *ever born* among married women who have just completed the childbearing span, say, wives 40-44 or 45-49 years of age.

In view of the above difficulties, students of the problem have recently used current birth registration data concerning parity (order of birth) for estimating what distributions of completed families, by size, would result from fertility levels of a given year. Whelpton and Jackson have thus reported that under conditions of birth rates existing during 1929-1931, 18 per cent of the white unbroken marriages (with bride under 45) in this country would be childless; 21 per cent would bear only one child, and 20 per cent would bear two children. Thus, a total of 59 per cent would fall into the under-developed class according to our definition. Approximately 21 per cent would bear three or four children, and the remaining 20 per cent would bear five children or more.[8]

The above distribution serves as a reminder that there are problems of the over-developed as well as those of the under-developed family. The number of families having 3-4 children is no greater than the number having five or more. Many studies have indicated that the problem of excessive fertility is a paramount one among under-privileged elements of our society, especially in poor rural areas. The *ideal* distribution of families by size might be that in which families with 3-4 children were more numerous than either the smaller or larger families. Something nearer to the ideal type of distribution might be attained by an effective population policy designed to encourage increase or limitation of family-size commensurate with economic and health conditions.

With the present subject, however, this paper is mainly concerned with the social implications of the under-developed family. Families bearing fewer than three children are in reality under-developed in the sense that they are too small to replace their numbers. On first thought it may appear that two children per family would be sufficient to replace the population since two parents are involved. Actually, however, to replace the population

[8] Whelpton, P. K. and Jackson, N. E.: Prolificacy Distribution of White Wives According to Fertility Tables for the Registration Area. *Human Biology*, February, 1940, xii, No. 1, p. 54.

in this country the fertile couples surviving the childbearing span should average about 3.3 children to compensate for women who never marry, for the sterile married women, for deaths of offspring, and for mortality of women before the completion of the childbearing span.[4]

The net reproduction rate takes the above factors into account and affords a measure of the extent to which a population is falling short of or surpassing replacement needs under current rates of fertility and mortality. A net reproduction rate of 1.0 means that under current age-specific mortality and fertility rates, 1,000 females born today would eventually bear a total of 1,000 daughters. The rate is hypothetical in that it assumes continuance of existing age-specific rates in fertility and mortality during the next generation, but a similar type of assumption regarding mortality underlies the construction of life tables and the well-known concept of expectation of life at birth.

A valuable characteristic of the net reproduction rate is that it removes the influence of age composition. At the present time our crude birth rate is higher than our crude death rate, only because we have an unduly large proportion of our population in younger ages of the childbearing span where birth rates are high and death rates low. Despite the fact that we now have fewer annual deaths than annual births, the net rate of reproduction for white women in the country as a whole in 1938 was just under 1.0. In other words, were it not for the favorable age structure, the births would scarcely balance deaths, even if there were no further declines in birth rates at specific ages. Stated in another manner, under current conditions of birth rates and death rates at specific ages, 1,000 newly-born white girl babies picked at random in the United States would be expected to bear somewhat fewer than 1,000 daughters during their lifetime.

[4] *Cf.* Lorimer, F. and Osborn, F.: DYNAMICS OF POPULATION. New York, The Macmillan Company, 1934, p. 284.

The above is the average situation for whites in the country as a whole. There are important elements in our population characterized by reproduction rates well below the level required for permanent replacement. According to data assembled for the National Resources Committee, the average reproduction rate for native whites in urban areas in 1930 was about 0.86, or 14 per cent below permanent replacement requirements. The deficit was 24 per cent in cities of 100,000 population or more. In cities of smallest size, 2,500-10,000, fertility was just about sufficient for population replacement on a permanent basis. On the other hand, in the total rural population the native whites were reproducing at a level about 54 per cent above replacement needs and in the rural farm population this excess was about 70 per cent. Negroes in rural farm areas were reproducing at a rate 80 per cent above replacement needs, but in all urban areas the fertility of Negroes fell below replacement needs—lower than for whites, and especially low in large cities. In cities of 100,000 population or over, the reproduction rate of Negroes in 1930 was 32 per cent below replacement requirements.[5]

On a geographic basis, one-fourth of the states in 1930 were characterized by reproduction rates too low for permanent population replacement. In six of these the total white population as of 1930 would fail to reproduce itself by 10 to 20 per cent. These were Oregon, New York, California, Washington, New Jersey, and Illinois. In six other states (Massachusetts, Rhode Island, Connecticut, Florida, Missouri, and Maryland), the deficit would be 10 per cent or less. On the other hand, states in the southeast and southwest and West Virginia, Utah, and North Dakota, constitute regions of high fertility.[6]

When the analysis is made by county in relation to plane of living it is found that poorest rural areas are characterized by highest rates

[5] National Resources Committee: THE PROBLEMS OF A CHANGING POPULATION. Washington, Government Printing Office, 1938, p. 134.

[6] *Ibid.*, p. 122.

of reproduction. Certain areas in the southern Appalachians are characterized by the highest rates of reproduction found among whites anywhere in the United States. If there were no migration to cities, the population of certain counties in West Virginia, southwestern Virginia, western North Carolina, eastern Kentucky, and eastern Tennessee would double in one generation.[7]

This imbalance in reproduction and especially the contrast between the low rates in cities and the high rates in poor rural areas brings us to what is possibly one of the major social concerns of the under-developed family. The pattern of family limitation is doubtless spreading from cities to rural areas. Nevertheless, it is in cities that the small family is so predominant and such areas must depend upon the countryside for population replacements. Some of the important rural reservoirs for replenishment of urban population are the rural problem areas where schools are poorest, where child health facilities are most meager, where the family and the community have least to offer to the cultural-intellectual growth of its future citizens. Careful students have seen in this situation the need for national responsibility for public education and for child and maternal health activities in rural areas.[8] The problem transcends local importance because many of the young people reared in such communities migrate to distant cities in search of employment. To mention this is a partial diversion to the subject of the over-developed family but perhaps one of the main potential effects of the under-developed family on society arises from the contrasting situations of small families in cities and largest families in poor rural areas.

A second set of social consequences arises from declines in the aggregate number of children. The 1930 Census was the first to

[7] *Ibid.*, pp. 122-123.

[8] *See* (a) Edwards, Newton: Equal Educational Opportunity for Youth. Washington, American Council on Education, 1939, pp. 147-152;
(b) Lenroot, K. F. and Myers, R. J.: Population Trends and Future Problems of Child Welfare. The Milbank Memorial Fund *Quarterly*, July, 1940, xviii, No. 3, pp. 198-213.

record an actual decline during the preceding ten years in the aggregate number of children under 5 years of age. The 1940 Census will be the first to record a decline in the number under 20 years of age. In 1930, there were over 48,000,000 children under 20; the 1940 enumeration will probably show about 46,000,000; and by 1960 there will be about 43,000,000 according to medium estimates of the Scripps Foundation. Since 1930, the number of children enrolled in elementary schools has decreased by over 1,000,000 and the declines are beginning to extend into the high schools. This situation of declining numbers of children is something new in our national experience. When the general public and the legislators become more aware of what is happening, a "population scare" may develop with resulting demands for hasty legislation designed to stimulate increase in size of family.

For some years Italy and Germany have attempted to boost the birth rate by monetary rewards for large families and by tax penalties on bachelorhood. These attempts were prompted in large part by military considerations. In contrast, a few years ago Sweden gave the world an example of a population policy which, though induced by concern over very low rates of reproduction in that country, was by no means directed toward the solitary aim of encouraging larger families. In fact, an integral part of the program was to make contraceptive knowledge available to all classes and to encourage its use by families for whom more children seemed ill-advised for reasons of ill-health, poverty, or other inadequacy. On the positive side, was the aim to enhance the attractions of voluntary parenthood by improving the community services for parents and especially for children. This program was integrated with broad measures of housing, public health, education, and general welfare. It is hoped that when a population policy is developed for this country it need not be dictated primarily by military considerations and that it will not be born of emotion or wishful thinking. Instead, in approach at least, it might well follow the pattern af-

forded by Sweden and be geared to long-range programs of health and welfare.

A third possible social effect of spread in the small family pattern is linked with the changing age structure. It is well in this connection to note the decline in proportion of children to the total population in relation to increases in that of the aged and to speculate on possible consequences for society. In 1900, children under 20 constituted approximately 44 per cent of the total population. Today, 1940, they comprise about 35 per cent and it is estimated that by 1980 they will form only about 25 per cent. On the other hand, individuals 65 and over comprised 4 per cent of the population in 1900; 6 per cent in 1940, and the medium estimate for 1980 is about 14 per cent. Thompson, Whelpton, and others have described at length the pervasive changes in consumer demands and in ways of life that may accompany an aging population. More and more the community in all of its ramifications may be geared to the life of elderly people rather than to that of children.

There is some danger that public services for children may be unduly curtailed in order to meet the increasing demands of the aged. It is true that the child burden will be lighter in the aggregate, whereas the problems of old-age dependency will become greater by virtue of increased numbers and proportion. But the Townsend movement and others of similar vintage are probably just examples of the organized demands that can be expected in the future from the aged and the near-aged. Dr. Clague of the Social Security Board has recently pointed out that, according to medium estimates, persons 45 years of age and over will constitute about 40 per cent of the total population and over half of the population of voting age in 1980. They will have the numerical strength to swing elections toward candidates specially committed to a furtherance of the interests of the aged.[9] Children, on the other hand, make poor lobby-

[9] Clague, E.: The Aging Population and Programs of Security. The Milbank Memorial Fund *Quarterly*, October, 1940, xviii, No. 4, p. 347.

ists. As the political power of the aged increases, so increases the danger that appropriations for public education and for child welfare will diminish in amounts disproportionate to reductions in numbers of children and regardless of the pressing need for improvement in educational facilities in rural problem areas where plane of living is lowest and birth rates highest.

The aging of the population may also tend to shift the emphasis of public health work to the aged.[10] Increases in average length of life during the past forty years in this country have accrued in large part from the lowering of death rates among young people and notably from savings in infant mortality. There has apparently been only minor improvement in life expectancy among people 40 years of age or over.[11] Whatever the future trend in this respect may be, the urgency of the problem of chronic diseases, for instance, will become greater as the number and proportion of people in advanced ages increase. Without attempting to minimize the need for increasing attention to the diseases of the aged, one may simply restate the necessity of being on guard lest provisions for child health be unduly curtailed, and to say again that public services for child health in rural areas are in a meager state of development.

Bordering on the social consequences of the under-developed family are the psychological aspects which can only be mentioned in this report.[12] Students, however, have written at length on the stabilizing effect of children on marital adjustments and have pointed to the higher rates of divorce among childless couples. The readier convenience of divorce among childless couples is doubtless a factor in this situation but few would argue that children have

[10] *See* Perrott, G. St.J. and Holland, Dorothy F.: Population Trends and Problems of Public Health. The Milbank Memorial Fund *Quarterly*, October, 1940, xviii, No. 4, pp. 359-392.

[11] *Cf.* Dublin, L. I. and Lotka, A. J.: LENGTH OF LIFE. New York, The Ronald Press Company, 1935, p. 68.

[12] For more detailed discussion, *see* Lorimer, F.; Winston, E.; and Kiser, L. K.: FOUNDATIONS OF AMERICAN POPULATION POLICY. New York, Harper and Brothers, 1940, pp. 131-138.

only a nuisance-value in keeping the family together. Another psychological aspect of the small family is that concerning the personality development of the children themselves, particularly that of the only child. Recognition of this problem has perhaps been no small element in the increasing popularity of kindergartens, nurseries, and community provisions for supervised recreation in urban centers.

It is not the intention of this paper to overemphasize the adverse consequences of the under-developed family. There have been many socially desirable accompaniments of the trend toward smaller families. Perhaps foremost among these has been the changed attitude regarding woman's place in society. Reductions in family size have acted both as cause and effect of woman's increased participation in activities outside the home. It should also be borne in mind that families may often be deliberately limited in size in order to assure maximum opportunities for the children.

From the standpoint of the community the decrease in aggregate number of children eases the total burden and permits efforts toward improvement in and more equitable distribution of facilities for popular education and for child welfare activities. With the spread of contraception, the rural-urban contrasts in birth rates and the problems attending this situation should tend to diminish. With regard to health, it should be pointed out that the very reductions in size of family have doubtless been conducive to declines in infant mortality rates by making possible better care per child. Students have also pointed out that the trend toward smaller families has greatly facilitated control of communicable diseases. The epidemic nature of these diseases can be better controlled when children in a community are distributed in small families than when they are distributed in large families, simply because there are fewer close family contacts among the children.

In broad summary, it may be said that the rise of the small family system has accompanied our transition from frontier agricultural

to urban industrial economy. We were not much concerned about the rural-urban differences in fertility as long as we had constant and substantial increases in the aggregate number of births. Now that nearly two-thirds of the population is urban and now that we are witnessing declines in school enrollments, we realize fairly suddenly the imminence of a stationary or declining population. The danger lies not in this situation but in the possibility of hasty public reaction to it, i.e., the danger of ill-considered schemes designed merely to increase the birth rate. A saner approach might be to take cognizance first of the inadequate provisions for child health and welfare in the rural areas where birth rates are high. Within the framework of maternal health programs there would appear to be a well-deserved place for the dispensing of reliable contraceptive advice in areas where too frequent pregnancies endanger the health of mothers and where extremely large families contribute to poverty. Such service would be an indispensable part of a well-rounded population policy, for the advent of a child into a family is too important to be a circumstance of ignorance and poverty. The ultimate objective might well be to maintain population replacement without sacrificing quality and to have the nation's children "wanted" by the families into which they are born. A different set of problems and complexities is encountered should we wish to stimulate desires for larger families among urban dwellers who now elect to have only one or two children. We need to know more about the social and psychological reasons for the small family among groups *free to choose*. It is possible, however, that nothing would contribute so powerfully to a new release of fertility among these people as a greater degree of social and economic security. The widespread attainment of these conditions may now appear remote; so there is all the more reason to guard well the health, lives, and training of children who are being born into this troubled world.

GYNECOLOGICAL CASE-FINDING IN MATERNAL HEALTH CLINICS

REGINE K. STIX, M.D.[1]

WITHIN recent years there has been a concerted drive on the part of the medical profession and public health agencies to effect a reduction in maternal mortality and morbidity. One agency that has received increasing recognition as a potential force in that drive has been the maternal health clinic. In stressing the value of child-spacing and the prevention of pregnancy when it is hazardous to the life and health of the mother, insufficient attention has been paid to another aspect of the services of the maternal health clinic in reducing maternal morbidity. Every woman given a contraceptive device in such a clinic has a pelvic examination. This procedure offers a unique opportunity for the detection of early pelvic pathology and permits patients to be referred for treatment before more serious pathology develops. Some indication of the types and extent of pelvic pathology found among patients of maternal health clinics can be derived from the study of detailed gynecological records of patients from two clinics in different sections of the United States.

In 1935, the Milbank Memorial Fund assisted the Spartanburg County (South Carolina) Health Department in setting up and evaluating a maternal health clinic in the Spartanburg General Hospital. The Maternal Health Clinic is an intramural clinic which accepts only patients who have been referred from other inpatient or outpatient services within the hospital, or who, if referred through sources outside the hospital, have first been examined in the medical clinic. The record of each maternal health clinic patient includes a digest of the medical history and diagnosis, a complete pelvic examination, and reports on a blood test for syphilis, a urine analysis, and cervical and urethral smears.

[1] From the Milbank Memorial Fund.

The clinic serves both white and Negro patients. Fifty-four per cent of the first 990 patients were white women, and the remainder were Negroes. In both the white and Negro groups, more than 60 per cent of the husbands were usually engaged in manual labor, in cotton mills or other industries in the County. Those remaining came from the rural sections of the County and were engaged in farming, usually as tenants or sharecroppers.

The white group came from a very low economic level. About 20 per cent of the urban families and 12 per cent of the farm families were on relief or were being supported by relatives when they first attended the clinic. The median income for nonrelief white families in the urban group was about $13 per week, or a little more than $650 per year. The cash income of the white rural families was practically nonexistent. Over 70 per cent of them had no cash income at all, and the mean for the entire group was about $2 per week.

The economic level of the Negro urban families was even lower than that of the white families. About one-fourth of them were on relief or were supported by relatives. The median urban nonrelief income was about $8 per week, or less than $450 per year. The rural Negro families appear to have been slightly better off than the white farm families, doubtless because some of the Negro wives worked as servants or took in laundry. Sixty-two per cent of the Negro farm families had no cash income, and the mean cash income for the group was $2.60 per week.

Most of the women sent to the contraceptive clinic were referred because of serious medical conditions or poor general health, or because they were having pregnancies too frequently for their own and their families' welfare (Table 1). About 5 per cent of them were referred because of pelvic conditions contraindicating pregnancy.

Women with sterilizing pathology were automatically excluded from the group since, with few exceptions, only overtly fertile wo-

Main Reason for Advising Contraception	White Women	Negro Women
Total Number of Women Advised[1]	532	455
	Per cent advised for each reason	
Total	100.1	100.0
Child Spacing Only	19.0	16.3
Tuberculosis or Tuberculosis Contact	4.9	1.5
Syphilis or Syphilis Contact	4.5	25.1
Cardiac or Vascular Disease	4.7	6.8
Pyelitis, Nephritis, or Previous Toxemia	10.7	6.8
Pellagra	5.1	0.4
Anemia or General Debility	32.7	27.7
Tumor	0.9	0.9
Diseases of Endocrine Origin[2]	3.4	2.2
Diseases of the Pelvis Other than Tumor	5.3	5.3
Neurological or Psychiatric Disease	2.1	0.2
All Other Reasons[3]	6.8	6.8
Child Spacing in Addition to Health	68.0	63.5

[1] Neither the medical diagnosis nor the reason for advising contraception was noted on the records of one white and two Negro women.

[2] Mainly diabetes and thyroid disease.

[3] Includes arthritis, diseases of the gastrointestinal tract other than tumor, varicose veins, phlebitis, nontuberculous diseases of the respiratory tract, obesity, dental caries, and infected tonsils.

Table 1. Distribution of reasons for advising contraception for patients of the Spartanburg Maternal Health Clinic.

men were referred to the contraceptive clinic. The exclusion of these cases suggests that the prevalence of severe pelvic infection and of other types of pelvic pathology tending to reduce fertility may be lower in this group than in a group differently selected. On the other hand, the prevalence of the types of pathology associated with frequent childbearing may be high because the clinic patients exhibited an extraordinarily high fertility.[2]

The prevalence of pelvic pathology was similar for the white and Negro groups. Some degree of perineal laceration was observed for

[2] The average length of marriage of both white and Negro women when they were examined at the clinic was less than ten years, and the average number of pregnancies per woman, standardized for age, was 5.3 for white women and 6.2 for Negro women. The mean number of children under five was more than twice as high for white women and more than three times as high for Negro women as the rates computed for whites and for Negroes in the County, from the 1930 Census returns.

90 per cent of the white women and approximately the same proportion of the Negro women, and about 80 per cent had cystocele or rectocele, or both (Table 2). It is doubtful whether operation for laceration or for relaxation of the pelvic floor would have been advisable in most of these cases, since contraception was little used

Table 2. Prevalence of pelvic pathology and venereal disease among patients of the Spartanburg Maternal Health Clinic.

Type of Pathology	White Women	Negro Women
Number of Women Examined[1]	531	456
	PER CENT OF TOTAL WITH EACH TYPE OF FINDING	
Perineal Laceration	90.0	90.5
Discharge	89.2	93.7
Purulent	3.6	3.8
Bloody	1.7	2.9
Mucoid[2]	83.9	87.0
Cystocele and/or Rectocele	79.3	81.6
Cervical Laceration	91.2	91.5
Laceration ± Erosion and/or Eversion	72.2	75.4
Laceration + Inflammation	19.0	16.1
Malposition of Uterus	63.3	58.8
Prolapse	0.6	0.5
Retroflexion	36.6	37.2
Retroversion ± Retroflexion	26.1	22.1
Pain and/or Tenderness in One or Both Tubes[3]	6.6	7.2
Pain and/or Tenderness in One or Both Ovaries[3]	6.8	7.5
Smear Positive for Gonorrhea	3.3	4.7
Smear Doubtful for Gonorrhea	1.0	2.3
Wassermann and/or Kahn Test +++ or ++++	4.4	25.1
Wassermann and/or Kahn Test + or ++	2.4	6.4

[1] There were only 525 complete pelvic examinations made on white women and 443 on Negro women, since in some cases one section or another of the record form was overlooked, and in others the uterus could not be palpated because of obesity. In each instance the proportion of defects noted was based on the known number of examinations of the organ under consideration.

[2] Or type not specified.

[3] The tubes and ovaries were palpable in only 23 per cent of the white cases and in 14 per cent of the Negro cases. The per cents of ovaries and tubes found to be tender and/or painful are based on the total number of women who had pelvic examinations.

and succeeding confinements would tend to break down any repairs made. Patients most seriously in need of them were referred for repair operations after they received contraceptive advice.

Laceration of the cervix was present in more than 91 per cent of the cases in both the white and Negro groups. Nineteen per cent of the white patients and 16 per cent of the Negroes had associated cervical inflammation. Many gynecologists have thought that chronic cervicitis offers a fertile field for the development of carcinoma of the cervix, and recently the American Society for the Control of Cancer has undertaken a study involving biennial pelvic examinations of 1,000 presumably healthy women, designed to show that carcinoma can be prevented by early treatment of this type of lesion.[8] If this hypothesis is supported by the findings, the care of the cervicitis cases discovered in the Spartanburg Clinic is in itself an invaluable health service.

About 60 per cent of the patients had some degree of malposition of the uterus. The types most frequently found were retroversion and retroflexion. In most instances the malposition was not marked, but a few patients were definitely in need of corrective procedures.

Approximately 7 per cent of the women examined had adnexal pain and/or tenderness, a finding suggestive of chronic pelvic inflammation. Salpingectomies were subsequently performed on four of the white women who showed evidence of adnexal inflammation, and four others had sterilizing pelvic operations which did not involve removal of the tubes or ovaries.

Positive smears for gonorrhea were obtained in 5 per cent of the Negro and 3 per cent of the white cases. An additional 2 per cent of the smears of the Negro women and 1 per cent of the smears of the white women were considered doubtful. These percentages prob-

[8] Macfarlane, Catharine: An Experiment in Cancer Control. *National Bulletin of the American Society for the Control of Cancer,* November, 1939, 21, No. 11, pp. 6-8.

In the first 1,000 examinations in this series, 22 per cent of the women examined were found to have laceration and/or inflammation or erosion of the cervix and were referred for care. Of these, three women were found on biopsy to have early unsuspected carcinoma of the cervix.

ably indicate the prevalence of relatively fresh gonorrheal infection in the Negro and white groups.

Twenty-five per cent of the Negroes, and 4 per cent of the white women had strongly positive Wassermann or Kahn reactions. An additional 6 per cent of the Negroes and 2 per cent of the white women had reactions entered as + or ++. Nineteen per cent of the Negroes with syphilis and 29 per cent of the whites with syphilis were referred for contraceptive advice from the venereal disease clinic. It is possible that a few additional cases, for which the referring agency was listed as "outpatient department," may also have had some treatment for venereal disease, but the majority of cases in both groups were new cases discovered when they came in for contraceptive advice.

Because of the selections in the sample, it is difficult to evaluate these data in terms of a community public health problem. It is possible, however, to assert that among women who did not voluntarily seek gynecological care the prevalence of pathology of all types was high. The detection and treatment of those cases that required medical care was an important contribution of the maternal health clinic to the public health and welfare. The contraceptive clinic may be especially valuable as a case-finding agency among indigent women because it has been very difficult to persuade women in low-income groups to seek medical care for any illness which does not incapacitate them. Women who would not ordinarily make the effort to seek medical care may be sufficiently interested in controlling the size of their families to seek advice on contraception. Once examined in the contraceptive clinic, it becomes possible to persuade many of them to return for the types of medical care found necessary as a result of examination.

Other data, showing the value of the contraceptive clinic as a gynecological case-finding service, were derived from the records of a selected group of patients from the clinics of the Cincinnati Committee on Maternal Health. Complete gynecological records

Social Class	Total Number of Women Receiving Contraceptive Advice	Per Cent of Total	
		Referred to Gynecological Clinic	Attending Gynecological Clinic at Least Once
All Women	1,621	26.7	20.7
Nonrelief Wives of—			
White-Collar Workers	266	20.7	16.2
Manual Workers	951	27.7	21.6
Wives of Relief Recipients	404	28.5	21.5

Table 3. Proportion of patients of each social class attending the clinics of the Cincinnati Committee on Maternal Health, who were referred for gynecological care, and proportion who attended the gynecological clinic.

were available only for those patients referred to the Committee's gynecological clinic. The data are not comparable with those from Spartanburg because of this selection.

The patients of the Cincinnati Maternal Health Clinics were all white women. Most of them were the wives of manual laborers or of relief recipients, but a few were married to white-collar workers. The median annual income of the nonrelief group was about $1,100. Thus, the women were in somewhat better economic circumstances than the patients of the Spartanburg clinic.[4]

About 28 per cent of the wives of manual workers and of relief recipients, and about 21 per cent of the white-collar workers' wives were referred from the contraceptive to the gynecological clinic. About three-fourths of those referred are known to have sought gynecological care at the clinic.[5] Records of complete pelvic examinations were available for slightly more than one-fifth of the women who received contraceptive advice (Table 3).

The findings in these pelvic examinations do not necessarily rep-

[4] For a more detailed description of the patients given contraceptive service, *see* Stix, R. K.: Birth Control in a Midwestern City. Part I. The Milbank Memorial Fund *Quarterly*, January, 1939, xvii, No. 1, pp. 72-74.

[5] A few of the records of women known to have attended the Committee's gynecological clinic were lost. At least eighteen women referred to that clinic are known to have sought treatment elsewhere.

Type of Pathology	Prevalence of Pathology
Number of Women Examined	308
	per cent of total with each type of finding
Perineal Laceration	5.5
Perineal Scar	3.2
Discharge	82.2
Purulent	73.1
Bloody	1.3
Mucoid	7.8
Cystocele and/or Rectocele	9.7
Cervical Laceration	82.4
Laceration ± Erosion and/or Eversion	34.7
Laceration + Inflammation	47.7
Malposition of Uterus	24.0
Retroflexion	12.3
Retroversion ± Retroflexion	11.7
Pain and/or Tenderness in One or Both Tubes	16.9
Pain and/or Tenderness in One or Both Ovaries	32.1

Table 4. Prevalence of pelvic pathology among Cincinnati Maternal Health Clinic patients referred for gynecological care.

resent all the pelvic pathology found in the contraceptive clinic, but only the types of pathology amenable to outpatient treatment. The patients appear to have been referred mainly for the care of inflammatory diseases of the cervix and adnexa. At least fifty-six women with other types of pathology, which could be corrected only by operation or which required special diagnostic procedures, were referred directly to hospitals for further diagnosis and treatment. A few, who could afford the services of a private physician, were sent to private physicians for care.[6]

The most significant types of pathology found on pelvic examination at the gynecological clinic are shown in Table 4. Cystocele or rectocele, or both, were found in about 10 per cent of the cases ex-

[6] These probably constituted less than 1 per cent of the group given contraceptive advice.

amined; perineal laceration was present in about 5 per cent, and in 3 per cent more the presence of scars showed that there had been perineal repair. About 12 per cent had some degree of retroversion of the uterus.

Some form of discharge was seen in 82 per cent of the cases; in 73 per cent it was purulent, and in most of the remainder mucoid. Eighty-two per cent of the women who were referred for gynecological care had laceration of the cervix, and in nearly 60 per cent of the cases showing laceration there was associated cervical inflammation. Only about 4 per cent of the cases examined showed inflammation without laceration. There was tenderness or pain in one or both tubes in 17 per cent of all cases. In nearly a third, pain or tenderness was reported for one or both ovaries.

Nearly 30 per cent of all the maternal health clinic patients were found to be in need of gynecological care, and slightly less than one-fourth of all patients given the routine pelvic examination in the contraceptive clinic made some attempt to have the conditions found corrected. These figures show, as do the findings for the Spartanburg patients, that the importance of the contraceptive clinic as a gynecological case-finding agency should not be underestimated. Actually, it is one of the few agencies providing the annual pelvic examination so frequently recommended by physicians interested in the prevention of gynecological morbidity.

In conclusion, data presented to show prevalence of pelvic pathology in two groups of women referred for contraceptive advice indicate that a considerable number were in need of gynecological treatment and operative procedures. The findings point to the importance of the contraceptive clinic as a case-finding and referral agency for women with pelvic pathology. The early detection and treatment of the types of pathology found in the two groups studied doubtless prevented the later development of more serious gynecological conditions, and constituted a real contribution to the health of the communities in which the two clinics operated.

MEDICAL EVALUATION OF NUTRITIONAL STATUS[1]

III. HEMOGLOBIN AND ERYTHROCYTE VALUES FOR ADOLESCENTS IN HIGH-INCOME FAMILIES

DOROTHY G. WIEHL

AMONG the dietary deficiencies that are reported in studies of food consumption for low-income families is an inadequate iron intake. During periods of growth the need for iron is especially high, and, therefore, the detection of this nutritional deficiency has been one part of the examination of a large number of high school students in New York City. The children were examined in a cooperative investigation of methods for appraising nutritional status. The purpose of the study and the procedures included in the examination have been described (1).

The present report is the first of a series in which the hematological findings for about 3,000 adolescent boys and girls will be discussed. The data in this report will be limited to those for a carefully selected group of about 300 boys and girls between 12 and 18 years of age. A detailed study of hemoglobin and erythrocyte values in this smaller group is necessary as a basis for the interpretation of findings for less privileged children in the larger group. This analysis represents only the first step in an attempt to give a more precise description of the hemoglobin and erythrocyte values that are characteristic of each sex and age during the adolescent period than has been found in the literature.

Iron-deficiency anemia has been extensively studied by hematologists, and the changes in hemoglobin content of the blood and changes in the number and size of erythrocytes have been described. The principal characteristic of iron-deficiency anemia is a reduction

[1] This paper is the third of a series from a cooperative investigation by the New York City Department of Health; the United States Public Health Service, Division of Public Health Methods; the Cornell University Medical College, Department of Public Health and Preventive Medicine and Department of Pediatrics; and the Milbank Memorial Fund.

The cooperating agencies have been assisted in carrying out this investigation by the Work Projects Administration for the City of New York, Official Project No. 65-1-97-21, W.P.24, "Medical Evaluation of Nutritional Status."

of the hemoglobin content of the blood. With this reduction there is a decrease in the hemoglobin content of the erythrocytes (hypochromia), and a diminution in cell size (microcytosis). The number of cells declines only slightly unless the deficiency has been chronic. Since all hypochromic, microcytic anemia is not due to an inadequate intake of iron, the etiology of such a condition must be determined by additional study; but the presence of hypochromia provides a basis for selecting cases of anemia.

It is obvious that the classification of an individual's blood-findings with respect to whether there is a *reduction* in hemoglobin level or in the number or size of erythrocytes is dependent upon well-established levels that are expected for persons whose blood-findings are not lowered. This expected value is commonly termed the "normal" or "standard" level, and, since some variation from this level is considered of no significance, a "normal" limit of variation, or an acceptable range, is used. It is fundamental to the interpretation of any finding as subnormal that the "normal" level and the limits used should represent values that are physiologically satisfactory.

Normal values in general use have been derived from hematological determinations on presumably healthy persons. For the data thus assembled, various statistical constants provide the values designated as "normal." Thus, the average value usually becomes the "normal" level and is the base line, that is the 100 per cent value, against which the deviation of any finding is measured. The "normal" limits are variously selected; they may represent some percentage of the observed values or some arbitrary amount of deviation from the average, such as 10 or 15 per cent. The application of the term "normal" to these averages and limits has the inevitable result that they acquire significance as values that are satisfactory to health. Consequently, the problem of determining standards that are desirable for health is oversimplified and its complex nature is obscured.

In this Study there is interest in detecting the cases with mild or slightly subnormal blood levels. For this purpose it is necessary to obtain the best possible indication of the hemoglobin and erythrocyte values that are to be expected for adolescent children apparently in good health. The approach is, in general, that mentioned above, namely, the analysis of frequency distributions of values obtained from examinations of carefully selected children. Some difference in individual values no doubt is without significance. But an attempt will be made to identify some of the characteristics or factors which may affect the hemoglobin or erythrocyte values in order that the effect of such factors may be taken into account when the findings on a given individual are interpreted as within the expected range or as lower than should be expected.

Since the reason for having standard or "normal" values is to appraise individual values, it is important that standards be derived from a sample that is representative of persons to whom they are applied. For example, if hemoglobin determinations are made for a group of white boys and girls aged 10 to 12 years in New York City, and all are considered as one group, the mean, standard deviation, and other statistical measures are specific for that group but do not necessarily give values which are typical of each sex and age, all nationality groups, and of children in other climates. Similarly, if individual characteristics, such as height, weight, or rate of growth, affect the hemoglobin level, a group of 12-year-old boys may not be representative of all 12-year-old boys. As distributions of values become available for groups which are homogeneous with respect to characteristics that influence the hemoglobin level, standard values can be set up which are more applicable to an individual, and what was previously an insignificant variation may become significant, and vice versa. Thus, knowledge of factors associated with variation makes it possible to take account of such factors and to evaluate the findings for an individual child against levels observed in children with similar characteristics that affect the hemoglobin level.

Such a measure of deviation from an expected value remains, however, a statistical expression of the probability or chances that any given hemoglobin value will occur among persons with specific characteristics. If the observed hemoglobin level is so low that it may be expected to occur only rarely, on the basis of available knowledge, it is taken as presumptive evidence that there is a deficiency of hemoglobin. The greater the odds against a given finding, the more significance may be attached to it.

It will be apparent that the levels selected at which individuals are classified as showing a hyper- or hypo-state are necessarily arbitrary; that is, there must be a decision as to how rare a particular value must have been in observed populations before it is considered as abnormal. Even if very large numbers of persons from a homogeneous population have been examined, there is no break in the frequency distribution to indicate the limits of normal, physiologic variation and to suggest which values are influenced by some degree of deficiency. The use of the term "normal" for selected levels is unfortunate, in the opinion of the writer. A terminology that would be more precise and specific is not readily suggested, but it seems possible that the meaning implied would be conveyed better by the term "standard." Standard is applied more commonly to measures that have an arbitrary basis, but it has the weakness that it does not imply the statistical concepts used in establishing the levels designated as standards. It is necessary to define a suggested standard with respect to the characteristics of the population to which it applies, and with respect to its statistical interpretation.

Another aspect of the problem of determining what hemoglobin or erythrocyte values indicate a mild or borderline deficiency is to determine what are the effects of a specific value. It is established that a marked deficiency of hemoglobin is deleterious to health and produces definite symptoms. But no sharp point of demarcation can be set at which no ill effect occurs. Further study of subjects who show slight deviations from average levels may reveal effects

that are not at present recognized. Such study may suggest additional diagnostic methods for detecting or classifying cases that will be more specific than a selection based on the statistical measure of the probabilities of the occurrence of a given finding. Functional and pathological effects of severe anemia have been studied, but persons with a mild deficiency of hemoglobin have received little attention. Study of the associated effects of a mild deficiency is an important part of the study of methods for appraising the nutritional status of an individual, but it is outside the scope of this report. It is mentioned chiefly because of its bearing on the acceptance of "normal" blood findings, as at present derived, as synonymous with a demonstrated good nutritional state.

An additional aspect of the interpretation of average values as satisfactory values arises from the fact that there is no basis for believing that average values observed for apparently well persons are ideal or optimal values. It has been found that infants with presumably normal hemoglobin values would utilize iron if given in proper form; and this has suggested that optimal levels may be higher than observed average values. Similarly, by giving iron supplements to adolescents with average hemoglobin, or slightly less, the utilization of additional amounts might be demonstrated.

Data on Standards for Adolescents

The data published on hemoglobin and erythrocyte values for adolescent children are scant and not in close agreement. Furthermore, this age period has been studied as a whole, with little or no attention to significant differences from year to year. In 1916, Williamson (2) collected data on hemoglobin content of the blood for over 900 persons of each sex and all ages from birth to over 75 years of age. He gave average values, based on 15 to 20 cases, for boys and for girls in the age groups 11-15 and 16-20 years. For boys, the average at 16-20 years was 16 per cent higher than that for ages 11-15 years; and for girls, the corresponding percentage was only 4 per

cent, but the 11-15 year old girls had an average hemoglobin value 9 per cent above the average for ages 6-10 years. Although the absolute values obtained by Williamson are now considered too high, the sex-age curves prepared by him have been widely used to indicate the *relative* hemoglobin level for children as compared with adult levels. In a recent book on hematology, Haden (3) reproduced the Williamson curves as a guide to determining the hemoglobin percentage typical of each sex and age period relative to the 15.4 grams of hemoglobin per 100 c.c. reported by him as normal for adult men. No specific recommendation is made for normal values during puberty when rapid changes in the hemoglobin level are shown.

By a series of studies on different groups in Oregon, Osgood and his coworkers (4) brought together data for each sex and for ages from 4 to 30 years. Determinations included erythrocyte counts, volume per cent of erythrocytes, hemoglobin in the blood, and a number of derived values. The average values for each sex, by single years of life, show a definite increase for all three determinations in the 'teen ages, with the exception of erythrocyte counts for girls. However, Osgood has not discussed the advisability of changing standards by age in this period, perhaps because his cases at each year were too few to afford dependable averages. Dividing the data into two broad age groups for each sex, he has suggested standards for ages 4 to 13 years and an adult level to be used from 14 to 30 years and older. The hemoglobin level suggested for both sexes under 14 years of age is 12.0 grams per 100 c.c., but the average level reported for the examined children 13 years of age is 12.89 for boys and 12.92 for girls. The adult level (14 years and older) recommended is 15.8 grams for boys and 13.8 for girls, although the averages for examined boys were about 14.6 and 15.3 grams[a] at ages 14 and 15 years respectively, and, for examined girls, the averages at single years of age from 14 years to 18 years varied from 14.0

[a] Values were read from the chart for ages over 13 years and are not exact.

grams to 14.6 grams, consistently higher than the standard. The standard range suggested is 14 to 18 grams for boys 14 years and older and 11.5 to 16 grams for girls. Obviously, among 14-year-old boys whose average hemoglobin level was only 14.6 grams, there will be a relatively large percentage with values below 14.0 grams (lower limit) as compared with 16 and 17-year-old boys whose average values equalled the standard average of 15.8 grams. Thus, these standards would not have the same meaning at each age in terms of the expected frequency of a given hemoglobin level.

The same age and sex division for standards is made by Osgood for erythrocyte counts, the "normal" level for both sexes 4 to 13 years of age being 5.0 million, for boys 14 years and older 5.4 million, and for girls 14 years and older being 4.8 million. In this case, too, the standards do not seem wholly satisfactory as criteria for evaluating the count at ages near the dividing line. The sex-age curves for volume per cent of red cells (hematocrit) obtained by Osgood, did not follow closely either the hemoglobin or the cell count curves. For females, there are two levels recommended as standards but the division is shifted to age 17 years; and for males, an additional age group is made, a special level for males 14 to 19 years being inserted between that for boys up to 14 years and that for men. This average level from 14 to 19 years is by no means adequate to represent each year of age since there was a steadily increasing volume of cells during the age period.

Data on healthy subjects have been reported also by Mugrage and Andresen (5, 6) from studies in Denver, Colorado. Both the hemoglobin and red cell values reported for adolescents in Denver differ markedly from those found in other studies, and it has been commonly accepted that the blood levels are affected by high altitude. Some data are available from several other studies on adolescent boys and girls, but no one study affords a satisfactory description of changes during this age period. All data are in agreement, however, that during adolescence there is a transition from

the values found in childhood to those found for adults and that the change is rapid, especially for boys.

Present evidence indicates the necessity for careful study of hemoglobin and erythrocyte values for each year of age for each sex in order to determine standard limits that are equally applicable at each age. Although the use of only a few standards makes for simplicity, average values for several ages which are characterized by significant differences do not permit careful evaluation of the blood findings for an individual in terms of the extent of his deviation from the standard level. To obtain standards which would provide the basis for identifying persons with lowered blood values and would have comparable meaning at each age, the data presented in the following pages were collected.

The Sample

The blood findings presented in this report are for a group of privileged children selected as being without apparent infection, disease, or nutritional deficiency. Nearly all were Jewish children, though not orthodox, attending a private high school in New York City (Fieldston School) and were from relatively high-income families. About 350 children were examined in February and March, 1940, but the blood findings for only 295 children have been used for the following tabulations. The results of the complete examination and of special tests for specific nutritional deficiencies were reviewed, and the hematological records for forty-one children were excluded on the basis of some acute or chronic condition that might possibly affect the hemoglobin level or red cell count.[8] A few other records were omitted for children who were older or younger than the specific ages included in this analysis because they were too few for special study. The boys included were from 12 to 18 years of age and the girls were from 12 to 17 years of age. Be-

[8] Nutritional deficiencies accounted for nine cases excluded; eight with ascorbic acid content of the blood less than 0.4 mg. per cent and one case of ariboflavinosis. Other causes for exclusion were heart conditions, sugar, albumin, hyaline and granular casts in the urine, positive serology, osteomyelitis, and enlarged cervical lymph nodes.

cause of the careful selection of children, it is believed that the findings may be considered representative of boys and girls from Jewish families in New York City who are without signs of infection or other illness.

Data and Laboratory Procedures

The hematological values to be discussed include the hemoglobin in whole blood, erythrocyte count, and erythrocyte volume per cent; and three values derived from these direct determinations; namely, mean hemoglobin content per erythrocyte, the mean hemoglobin concentration per 100 c.c. of erythrocytes, and the mean red cell volume. All determinations were made on a blood specimen taken by venipuncture at about 8:30 a.m. before the child had breakfast.

The technique of the erythrocyte count followed standard procedure. Trenner pipettes diluting 1 to 200 and Levy counting chambers with improved Neubauer double-ruling were used. The blood specimen was thoroughly mixed in its vial, and each of two pipettes was filled with Hayem's solution as diluent. The one pipette was shaken for 60 seconds in a Hauser shaker just before being used to charge each of the two ruled areas of one chamber. The other pipette was similarly treated and used to charge the two ruled areas of the second counting chamber. Thus, four ruled areas were prepared for counting, and a photograph of each was made with the euscope (7). This instrument affords a simple mechanism for making a photograph, measuring 4 by 5 inches, on bromide paper. Cells in five groups of 16 of the smallest squares or in a total of 80 small squares (0.02 c.mm. of diluted blood), were counted on each photograph. The cumulative total was read from a tally counter which is equipped with a needle-like pointer and counts automatically as each cell is pierced with this pointer. The count was verified by examining each square to determine whether all cells had been punched and whether those on the lines had been properly counted in or out of the ruled area. Thus, errors in counting are eliminated,

but the sampling error remains. No counts were arbitrarily discarded on the basis of large differences between counts for the several ruled areas.

The volume per cent of packed red blood cells was determined by hematocrit according to the method of Wintrobe (8). The tube was centrifuged at 3,000 revolutions per minute for one-half hour.

The hemoglobin determination is based upon the colorimetric determination of oxyhemoglobin by the Evelyn method, using the photoelectric colorimeter (9). The K_2 value used in calculating the results from galvanometer readings was determined by standardization of the instrument against bloods of various hemoglobin concentration as determined by their oxygen capacity (10, 11).

Results of Hematological Examinations on a Privileged Group

Frequency distributions for boys and for girls at each year of age are given in appendix tables for the following hematological values: Table I, hemoglobin in whole blood; Table II, erythrocyte counts; Table III, volume of packed red cells, percentage; Table IV, mean volume of red cells, cubic microns; Table V, mean hemoglobin content per cell, micromicrograms; Table VI, concentration of hemoglobin in red cells, grams per cent. These tables give in detail the data for the 155 boys and 140 girls in high-income families from which average values and other statistical constants have been derived.

For each of the six hematological values, similar statistical measures that describe the frequency distributions are presented as a basis for discussion. In addition to the mean value at each age, the standard error of the mean and the standard deviation of the distribution, several values are given which divide the total distribution into various percentages. Thus, the median value indicates the level at which 50 per cent of the observed values were greater and 50 per cent were smaller; the first and third quartile values indicate,

respectively, the level at which 25 per cent of the observed values were smaller and 25 per cent were greater. Between the first quartile level and the third quartile level, there is included the middle 50 per cent of observed values. Similarly, the first and ninth deciles shown in the table represent the levels below and above which 10 per cent of the distribution of values was found; and 80 per cent of the distribution is included between the first and ninth deciles.[4] The levels for these various percentage limits are portrayed graphically for each set of values.

The median and average values are equal when the observed values above and below the median level vary by the same amount. A higher median indicates that the distribution is skewed downward, or weighted by relatively low individual values in the distribution; and a lower median indicates a greater spread of values in the upper half of the distribution. Thus, the median provides a central value on which the effect of a few extreme observations has been eliminated, and seems especially useful for these data, since extreme variations may well be atypical. On the other hand, the mean and the standard deviation provide a better basis for estimating the probability of the occurrence of specific high or low values if the sample distribution is typical and not greatly skewed.

Hemoglobin in Whole Blood. The trend in hemoglobin values for boys and girls from 12 to 17 years of age is clearly seen in Figure 1. The difference by sex is very marked. The median line for girls shows only slight variations from age to age, the highest median value being 13.9 gms. per 100 c.c. at age 14 years and the lowest, 13.6 gms. at age 17 years. But the median line for boys rises steadily and sharply from 13.7 gms. at age 12 years to 15.4 gms. at ages 17-18 years. At 12 years of age the mean hemoglobin value for girls (Table 1) was slightly higher than that for boys but the difference

[4] The percentage levels, computed in the usual way for grouped data, represent *estimated levels* for the frequency distributions, and not *observed values* for persons at the specified point in the arrayed series of observed values. The decile limits are subject to great variability when computed for frequencies as small as the eighteen to thirty-four cases available for this analysis.

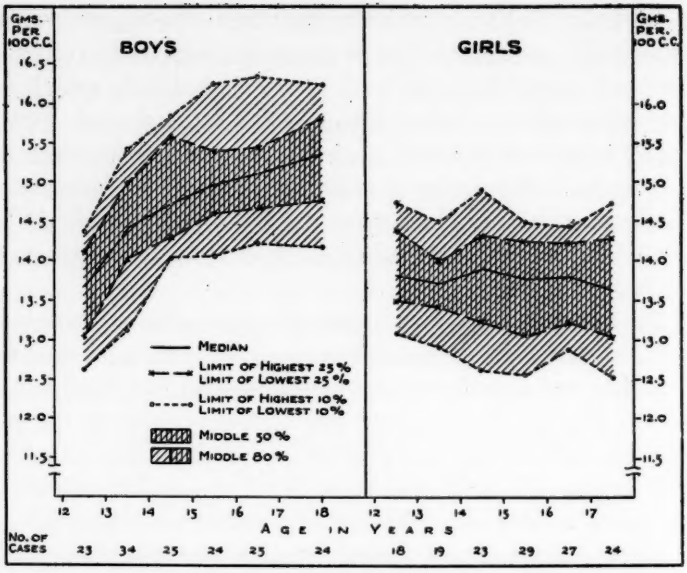


Fig. 1. Hemoglobin in whole blood. Selected percentiles for frequency distributions of values for boys and for girls at specific ages.

was not statistically significant.[5] At all other ages, the hemoglobin level was lower for girls and the difference was highly significant at every age.

For 12-year-old girls in this sample, the median hemoglobin value was 13.8 grams per 100 c.c. (mean 13.9 gms.) and was as high as that usually reported and used for standard for adult women. Comparison of the width of the shaded area above and below the median line for girls, in Figure 1, reveals a tendency for the area above the line to be slightly wider at ages 12 and 13 years, but after 13 years of age the area below the median becomes wider, indicating that the distributions were slightly skewed. The interpretation

[5] The consistent practice in this discussion with reference to statistical significance will be to consider *differences* as not statistically significant if, on the basis of the t value, the probability is greater than .05; if the probability is between .05 and .02, differences will be termed significant; if the probability is .02 or less, the difference will be termed *very*, or *highly* significant.

Sex and Age	Number of Cases	Mean and Standard Error	Standard Deviation	Median	Quartiles		Deciles	
					First	Third	First	Ninth
Boys								
12	23	13.62 ± 0.14	0.65	13.66	13.04	14.11	12.61	14.36
13	34	14.44 ± 0.15	0.88	14.40	14.02	14.99	13.12	15.42
14	25	14.87 ± 0.16	0.79	14.70	14.28	15.58	14.04	15.84
15	24	15.10 ± 0.17	0.83	14.95	14.58	15.38	14.05	16.25
16	25	15.19 ± 0.15	0.75	15.09	14.64	15.44	14.20	16.32
17–18	24	15.29 ± 0.16	0.77	15.35	14.75	15.81	14.15	16.22
Girls								
12	18	13.92 ± 0.14	0.59	13.81	13.49	14.37	13.08	14.72
13	19	13.72 ± 0.14	0.60	13.70	13.41	13.99	12.90	14.48
14	23	13.79 ± 0.20	0.94	13.89	13.22	14.32	12.60	14.88
15	29	13.68 ± 0.15	0.81	13.76	13.05	14.24	12.56	14.48
16	27	13.73 ± 0.15	0.79	13.80	13.22	14.21	12.88	14.42
17	24	13.69 ± 0.17	0.83	13.62	13.03	14.28	12.52	14.72

Table 1. Grams of hemoglobin per 100 c.c. of blood according to sex and age for Jewish children in high-income families. Mean and standard deviation and selected percentiles for frequency distributions shown in Appendix Table I.

of this skewness is not clear, but there is always a possibility that some low values at the extreme limits represent slight deficiencies.

For boys, the greatest increase in hemoglobin between any two successive years of age is shown at ages 12 and 13 years. The difference in the mean hemoglobin content of the blood at these ages was 0.82 grams and is highly significant. Although the differences between successive ages were not significant statistically for any other ages, the consistent increase with age provides unquestionable evidence of a significant physiological trend during this age period.

The width of the shaded area above the median line for boys at ages 14-16 years, inclusive, indicates some skewness in the frequency distributions toward higher values. This suggests all the boys of one specific chronological age had not progressed toward the higher values to the same extent, and, at these intermediate ages, the spread in the higher values is widened by boys with more rapid progress in their physiological change.

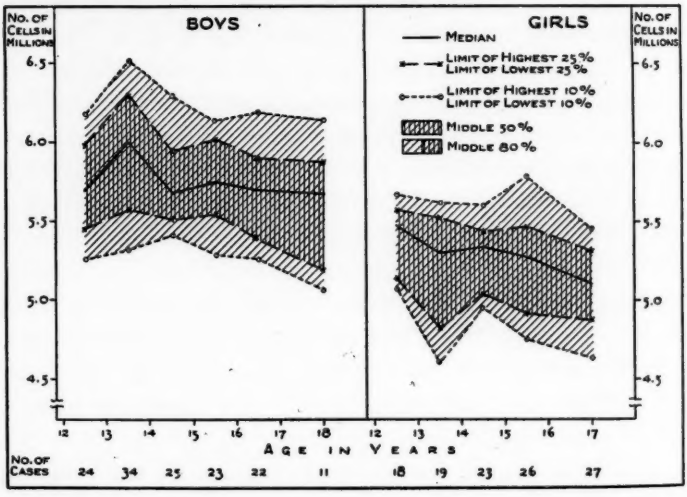
Erythrocyte Counts. The statistical measures for the frequency

Sex and Age	Number of Cases	Mean and Standard Error	Standard Deviation	Median	Quartiles		Deciles	
					First	Third	First	Ninth
Boys								
12	24	5.68 ± 0.07	0.37	5.70	5.45	5.98	5.27	6.18
13	34	5.94 ± 0.08	0.47	6.00	5.57	6.30	5.32	6.51
14	25	5.76 ± 0.06	0.31	5.68	5.51	5.94	5.41	6.29
15	23	5.74 ± 0.09	0.43	5.79	5.54	6.02	5.28	6.14
16	22	5.69 ± 0.08	0.37	5.70	5.38	5.90	5.26	6.19
17–18	11	5.54 ± 0.14	0.47	5.68	5.19	5.88	5.06	6.14
Girls								
12	18	5.38 ± 0.06	0.27	5.47	5.14	5.57	5.07	5.67
13	19	5.18 ± 0.09	0.40	5.30	4.82	5.52	4.60	5.62
14	23	5.27 ± 0.06	0.28	5.34	5.04	5.44	4.96	5.61
15	26	5.26 ± 0.07	0.36	5.28	4.92	5.47	4.77	5.79
16–17	28	5.09 ± 0.06	0.32	5.11	4.88	5.32	4.64	5.46

Table 2. Number of erythrocytes per c.mm. in millions according to sex and age for Jewish children in high-income families. Mean and standard deviation and selected percentiles for frequency distributions shown in Appendix Table II.

distributions of red blood cell counts are presented in Table 2 and Figure 2.

Fig. 2. Erythrocyte count per c.mm. of blood. Selected percentiles for frequency distributions of counts for boys and for girls at specific ages.



The mean count of red cells for boys was higher than that for girls by about 0.5 million cells or more at each age over 12 years, and the difference was highly significant at every age. At 12 years the difference was 0.3 million, and it also was very significant.

The trend in the number of red cells from age to age was very different from the trend in hemoglobin values, both for boys and for girls, as can be clearly seen in Figure 2. The median line in Figure 2 for girls shows a definite, though somewhat irregular, downward trend over the age period. Differences in the mean value from one age to the next were not statistically significant, but the difference between the mean count at age 12 years (5.4 million) and at ages 16-17 combined (5.1 million) was very significant. Skewness shown by the shaded area in the chart is toward the lower values and in the direction in which a trend is indicated.

For boys, the median line in Figure 2 is approximately 5.7 million red blood cells at every age except 13 years. At 13 years the median red cell count rose sharply to about 6.0 million and then dropped back to the 5.7 million level. The difference in the mean count at 12 years and that at 13 years was 0.26 million and is significant, but the difference between the mean at 13 years and at 14 years was not significant. Differences between average counts were less at these ages than differences between the medians due to a shifting in the skewness of the distribution from low values at age 13 to high values at age 14 years. This increase in red blood cells, which coincided by age with the period of most rapid increase in hemoglobin, apparently represents a significant though temporary shift in the erythrocyte level.

Hematocrit. Changes in the volume per cent of packed red cells from age to age are depicted graphically in Figure 3 and the mean, median, and measures of dispersion of the distribution are given in Table 3.

For girls, the median line in Figure 3 is very irregular and shows no constant trend. However, the highest average value (and median

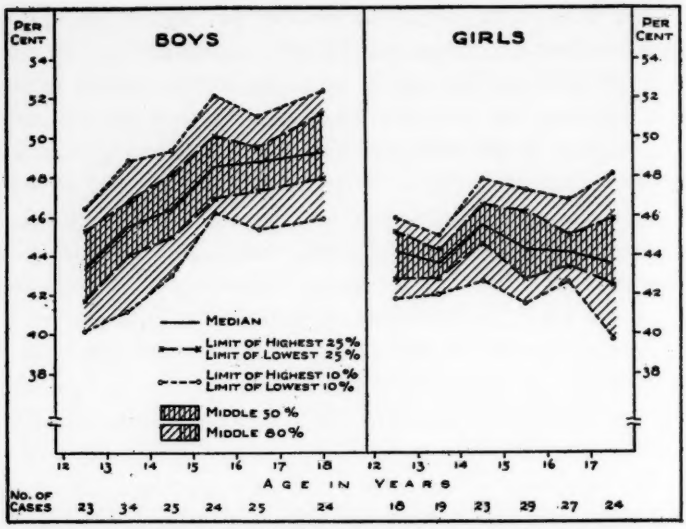


Fig. 3. Percentage volume of packed red cells (hematocrit). Selected percentiles for frequency distributions of values for boys and for girls at specific ages.

value) for girls was at age 14 years, and it was significantly higher

Table 3. Percentage volume of packed red cells (hematocrit) according to sex and age for Jewish children in high-income families. Mean and standard deviation and selected percentiles for frequency distributions shown in Appendix Table III.

Sex and Age	Number of Cases	Mean and Standard Error	Standard Deviation	Median	Quartiles		Deciles	
					First	Third	First	Ninth
Boys								
12	23	43.35 ± 0.48	2.30	43.33	41.69	45.25	40.15	46.40
13	34	45.32 ± 0.44	2.58	45.50	44.00	46.75	41.20	48.80
14	25	46.40 ± 0.50	2.50	46.38	44.95	48.08	43.00	49.33
15	24	48.75 ± 0.51	2.51	48.50	46.93	50.50	46.20	52.10
16	25	48.52 ± 0.40	2.02	48.78	47.25	49.47	45.33	51.00
17–18	24	49.25 ± 0.51	2.49	49.25	47.90	51.17	45.90	52.37
Girls								
12	18	43.94 ± 0.39	1.67	44.25	42.75	45.20	41.77	45.90
13	19	43.63 ± 0.33	1.45	43.57	42.79	44.25	41.95	45.05
14	23	45.52 ± 0.58	2.79	45.58	44.62	46.58	42.65	47.85
15	29	44.48 ± 0.43	2.30	44.33	42.71	46.25	41.47	47.28
16	27	44.63 ± 0.46	2.36	44.15	43.45	45.04	42.64	46.80
17	24	43.88 ± 0.59	2.91	43.50	42.50	45.90	39.70	48.10

than the average values at ages 12 and 13 years and at 17 years. This, again, would suggest that a real change in hematocrit was occurring during this period. If the size of the red cells remained the same, the volume per cent of cells would vary with the number of cells, but since the hematocrit trend from age to age does not follow closely the trend in the red cell count, the explanation must be looked for in the mean size of cells.

The median line for boys (Fig. 3) indicates a rapidly increasing volume of red cells from ages 12-15 years, inclusive, and a further gradual increase at older ages. It resembles the median line for hemoglobin in whole blood, but there are minor differences in the steepness of the curve at some ages.

Size of Red Cells. The mean volume of red cells in cubic microns was estimated by the usual method of dividing the hematocrit percentage by the red cell count. The formula is:

$$\frac{\text{Volume per cent of packed red cells x 10}}{\text{R. B. C. in millions per c.mm. of blood}} = \text{mean cubic microns.}$$

The averages, medians, and other values for the several distributions of individual findings are shown in Table 4, and the percentage limits are given also in Figure 4.

The median line in Figure 4 which portrays the change in the mean cell volume for girls from age to age shows a definite upward trend from 12 to 14 years, and the increase thereafter is slight. Thus, the median for red cell size at age 12 years was 82.1 cubic microns and increased to 86.2 at age 14 years. During these years we have seen that there was no evidence of a significant change in hemoglobin in the blood, but the red cell count showed some reduction and the hematocrit increased. The indication seems definite that during adolescence one part of the hematological change is the size of red cells and this change was in progress over a number of years after the increase in hemoglobin in whole blood had been completed. The larger mean size of cells for girls than for boys at

Sex and Age	Number of Cases	Mean and Standard Error	Standard Deviation	Median	Quartiles		Deciles	
					First	Third	First	Ninth
Boys								
12	22	76.50 ± 0.78	3.65	76.70	74.75	78.25	71.60	81.30
13	34	76.56 ± 0.84	4.92	76.17	73.38	79.33	71.97	82.22
14	25	80.84 ± 1.14	5.70	80.00	77.25	83.88	75.00	88.00
15	23	85.61 ± 1.75	8.42	84.67	80.25	87.92	76.80	99.20
16	22	85.32 ± 1.40	6.56	85.50	80.00	91.00	76.10	92.43
17–18	11	87.73 ± 1.78	5.92	87.25	85.25	88.75	80.60	94.40
Girls								
12	18	82.06 ± 0.85	3.63	81.83	80.25	83.75	77.30	87.10
13	19	84.63 ± 1.39	6.08	84.00	79.25	86.75	77.80	94.60
14	23	86.17 ± 1.15	5.51	85.88	83.08	88.75	79.65	93.20
15	26	84.92 ± 0.96	4.88	85.83	80.25	88.00	78.30	90.90
16–17	27	87.78 ± 0.94	4.91	87.00	84.69	91.62	81.35	94.93

Table 4. Red cell mean volume in cubic microns according to sex and age for Jewish children in high-income families. Mean and standard deviation and selected percentiles for frequency distributions shown in Appendix Table IV.

age 12 years also suggests that some change in cell size for girls occurred before age 12 years.

The change in red cell size for boys, shown from ages 12 years to 18 years, is greater than that for girls but is of the same nature. There was no increase in the average cell size for boys aged 13 years as compared with those aged 12 years, although hemoglobin in whole blood increased and the number of cells increased. But at ages 14 and 15 years the median value for mean cell volume was much higher than in the preceding year of age. This increase in cell size for boys was concurrent with a continued rising hemoglobin level, whereas in the case of girls the hemoglobin level was not changing. Since boys experience their adolescent growth and development at a later age than girls, the 12 and 13-year-old boys examined probably give a picture of the first changes in the hemoglobin and erythrocyte values; but the 12 and 13-year-old girls in this Study seem already to have progressed beyond the earliest changes.

At the same chronological age, from 12-14 years inclusive, the

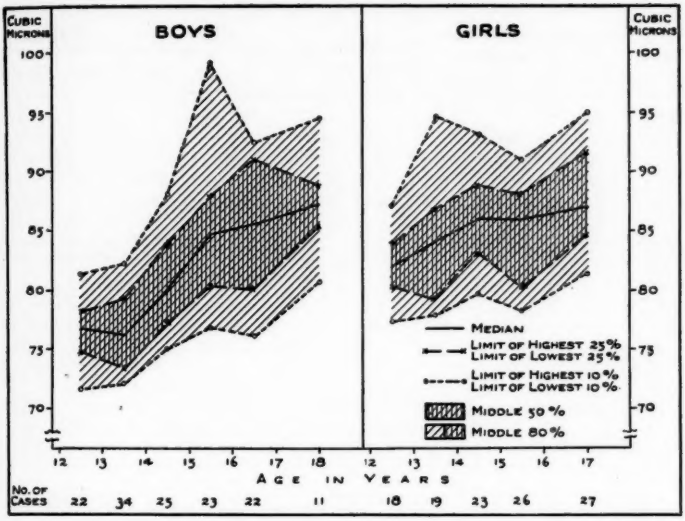


Fig. 4. Mean volume of red blood cells. Selected percentiles for frequency distributions of mean volume for boys and for girls at specific ages.

averages for mean cell size for boys were much smaller than for girls and the differences were highly significant. At age 15 years and older the differences for the two sexes were not significant. Thus, the increase in red blood cell volume started at a later age for boys but progressed more rapidly, and by age 15 years little difference remained.

Mean Hemoglobin Content per Cell. From the hemoglobin content of whole blood and the red cell count, the mean hemoglobin content per cell is calculated as follows:

$$\frac{\text{Hemoglobin, grams per 100 c.c. blood} \times 100}{\text{R. B. C. in millions per c.mm. of blood}} = \text{mean hemoglobin content per cell, micromicrograms.}$$

The average and median values and other statistical measures for the distributions of findings for each sex-age group are shown in Table 5 and Figure 5.

In general, we should expect the trend in the hemoglobin con-

Sex and Age	Number of Cases	Mean and Standard Error	Standard Deviation	Median	Quartiles		Deciles	
					First	Third	First	Ninth
Boys								
12	22	24.00 ± 0.30	1.42	23.95	23.10	25.01	22.05	25.43
13	34	24.38 ± 0.25	1.46	24.09	23.39	25.14	22.75	25.88
14	25	25.77 ± 0.29	1.44	25.99	24.86	26.64	23.70	27.53
15	23	26.47 ± 0.51	2.44	26.20	25.08	27.22	23.60	28.80
16	22	26.52 ± 0.32	1.48	26.45	25.39	27.30	24.98	28.35
17–18	11	27.38 ± 0.51	1.69	26.87	26.39	28.58	25.98	29.40
Girls								
12	18	26.00 ± 0.31	1.32	25.95	25.03	26.58	24.40	27.25
13	19	26.46 ± 0.43	1.86	25.76	24.89	28.08	24.27	29.22
14	23	26.08 ± 0.33	1.60	26.20	25.08	26.88	23.78	27.80
15	26	26.12 ± 0.29	1.49	26.53	25.08	27.14	23.72	27.68
16–17	27	27.20 ± 0.30	1.53	27.20	25.92	28.55	25.38	28.89

Table 5. Mean hemoglobin content per cell in micromicrograms according to sex and age for Jewish children in high-income families. Mean and standard deviation and selected percentiles for frequency distributions shown in Appendix Table V.

tent per cell to follow closely that noted for red cell size with advancing age of boys and girls during adolescence. The median lines in Figures 4 and 5 are quite similar but there are some small differences in the changes at several ages. This is not surprising since it is apparent that the red blood cells are in a state of transition and neither the size nor the content are on a stable basis during this age period. Both were definitely increasing and it is not clear from these data whether this increase was complete for the oldest groups, 16-17 years for girls and 17-18 years for boys.

At ages 12 and 13 years the differences between the mean hemoglobin content per cell for boys and for girls were highly significant statistically. At age 14 years and at older ages the differences between average values for the sexes were small and not significant.

Mean Hemoglobin Concentration in Cells. The saturation of the red cells with hemoglobin is estimated as follows:

$$\frac{\text{Hemoglobin, grams per 100 c.c. x 100}}{\text{Volume of packed red cells, per cent}} = \text{Hb. concentration (grams per cent)}$$

The values describing the frequency distributions of hemoglobin

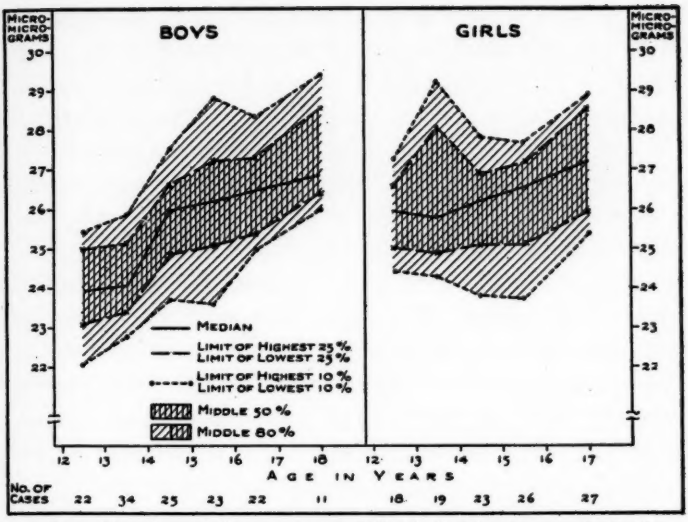


Fig. 5. Mean hemoglobin content per red blood cell. Selected percentiles for frequency distributions of mean content for boys and for girls at specific ages.

concentration in the red cells for boys and girls at each age are

Table 6. Percentage concentration of hemoglobin in red blood cells according to sex and age for Jewish children in high-income families. Mean and standard deviation and selected percentiles for frequency distributions shown in Appendix Table VI.

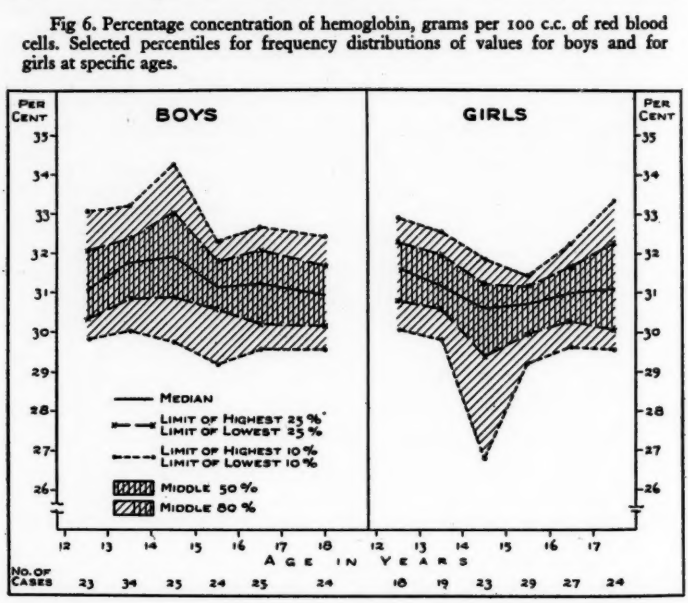
Sex and Age	Number of Cases	Mean and Standard Error	Standard Deviation	Median	Quartiles		Deciles	
					First	Third	First	Ninth
Boys								
12	23	31.35 ± 0.30	1.43	31.06	30.32	32.06	29.83	33.07
13	34	31.79 ± 0.24	1.39	31.79	30.86	32.39	30.07	33.22
14	25	32.00 ± 0.34	1.71	31.92	30.88	33.05	29.75	34.25
15	24	30.96 ± 0.26	1.28	31.14	30.59	31.79	29.20	32.30
16	25	31.12 ± 0.25	1.27	31.25	30.21	32.09	29.58	32.67
17–18	24	31.08 ± 0.29	1.44	30.94	30.17	31.70	29.57	32.42
Girls								
12	18	31.56 ± 0.23	0.97	31.64	30.80	32.29	30.10	32.90
13	19	31.21 ± 0.23	1.02	31.19	30.59	31.95	29.80	32.55
14	23	30.09 ± 0.42	2.02	30.60	29.38	31.22	26.80	31.85
15	29	30.59 ± 0.17	0.91	30.72	29.96	31.17	29.22	31.44
16	27	30.67 ± 0.41	2.13	31.00	30.29	31.68	29.62	32.26
17	24	31.21 ± 0.35	1.70	31.10	30.07	32.30	29.56	33.37

shown in Table 6 and Figure 6. The differences in the averages by age are relatively small but some of them were significant.

For girls, the concentration of hemoglobin in the cells declined from age 12 years to 14 years. The differences between the averages at 12 and 14 years and at 13 and 14 years were, respectively, very significant and significant. This coincides with the ages at which we have noted a rapid increase in mean cell volume and a more gradual increase in the mean hemoglobin content per cell.

For boys, there was a rise in the concentration value at ages 13 and 14 years, followed by a decline to a value which remained constant for ages 15 years and older. The differences in the average value at age 14 years and the lower averages at older ages were significant. This temporary change in the concentration of hemoglobin in the cells apparently was the result of rapid changes already noted in hemoglobin in whole blood and in content per cell asso-

Fig 6. Percentage concentration of hemoglobin, grams per 100 c.c. of red blood cells. Selected percentiles for frequency distributions of values for boys and for girls at specific ages.



ciated with a somewhat slower increase in the mean cell volume.

The mean hemoglobin concentration in red cells has been found to be very constant in studies on various groups. Even for this adolescent group the changes were not great but they are of interest because they indicate a somewhat unstable equilibrium associated with the transition from values in childhood to those in adult life.

Summary

Hemoglobin and erythrocyte values for 155 boys, aged 12 to 18 years inclusive, and for 140 girls, aged 12 to 17 years inclusive, have been presented. All were attending a private school in New York City and were mostly from Jewish families with relatively high incomes.

The statistical basis on which standards for hemoglobin and erythrocyte values are established was discussed; and it was pointed out that the interpretation of individual findings requires that the standards used be (a) derived from data on a population with characteristics, which affect the blood levels, that were similar to those of the persons under investigation, and (b) of comparable meaning, in terms of statistical significance of limits.

For girls in this Study, the change from childhood levels apparently began before age 12 years. In the age period 12-17 years, some of the changes were:

Hemoglobin in whole blood was about the same at every age, the averages at specific ages varying from 13.9 gms. per 100 c.c. to 13.7 gms.

The number of red cells per c. mm. of blood decreased with age from 5.4 to 5.1 millions.

Mean red cell volume increased from 82.1 cubic microns at age 12 to 87.8 at 16-17 years combined.

Hemoglobin content per cell increased slightly with age, from 26.0 to 27.2 micromicrograms.

Concentration of hemoglobin in red cells varied significantly at these ages.

For boys, hemoglobin and erythrocyte values during the age

period 12-18 years showed greater changes than for girls for all determinations except the concentration of hemoglobin in cells. Some of the changes in average values for boys were as follows:

Hemoglobin in whole blood increased from 13.6 gms. per 100 c.c. at age 12 years to 15.3 at ages 17-18 combined, and most of the increase was at ages 13 and 14 years.

A rise in the number of red cells at age 13 years was followed by a decline to a fairly constant count of about 5.7 million.

Mean red cell volume increased from 76.6 cubic microns at age 13 years to 85.6 at 15 years, and was 87.7 at 17-18 years of age.

Mean hemoglobin content per cell increased from 24.0 micromicrograms at age 12 years to 27.4 at ages 17-18 years.

Significant differences between average values for boys and girls were:

Hemoglobin level higher for boys at every age except 12 years.

Red cell count higher for boys at every age.

Mean volume of red cells smaller for boys aged 12, 13, and 14 years, not significantly different at older ages.

Mean hemoglobin per cell lower for boys aged 12 and 13 years, not significantly different at older ages.

The marked changes during adolescent period make it necessary to use different standards by sex and year of age. Furthermore, it must be borne in mind that average values by chronological age do not take fully into account the stage in physiological change which we have found affects hemoglobin and red blood cell values.

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Appendix Table I. Grams of hemoglobin in whole blood according to sex and age for Jewish children in high-income families in New York City.

GRAMS PER 100 C.C.	BOYS						GIRLS					
	Number at Each Age With Specified Finding						Number at Each Age With Specified Finding					
	12	13	14	15	16	17–18	12	13	14	15	16	17
TOTAL	23	34	25	24	25	24	18	19	23	29	27	24
11.0–11.9									1	1	1	
12.0–12.9	5	2	1				1	2	2	5	2	5
13.0–13.9	10	5		2	1	2	10	12	9	10	12	9
14.0–14.9	8	18	15	10	9	6	7	5	9	12	11	9
15.0–15.9		8	8	9	11	12			2	1	1	1
16.0–16.9		1	1	2	4	4						
17.0–17.9				1								

Appendix Table II. Erythrocyte counts according to sex and age for Jewish children in high-income families in New York City.

NUMBER OF RED CELLS IN MILLIONS PER C. MM.	BOYS						GIRLS				
	Number at Each Age With Specified Finding						Number at Each Age With Specified Finding				
	12	13	14	15	16	17–18	12	13	14	15	16–17
TOTAL	24	34	25	23	22	11	18	19	23	26	28
4.4–4.5				1				1	1		1
4.6–4.7						1	1	3		2	4
4.8–4.9	1							2	1	5	5
5.0–5.1		1			1	1	4	2	5	2	6
5.2–5.3	3	3		2	4	3	2	3	5	7	6
5.4–5.5	6	4	8	3	3		6	4	7	6	5
5.6–5.7	3	3	6	4	4	2	4	4	4	1	
5.8–5.9	4	5	5	5	5	2	1			1	1
6.0–6.1	4	6	1	6	2	1				2	
6.2–6.3	3	5	5		2	1					
6.4–6.5		4		2	1						
6.6–6.7		2									
6.8–6.9		1									

Per Cent	Boys						Girls					
	Number at Each Age With Specified Finding						Number at Each Age With Specified Finding					
	12	13	14	15	16	17–18	12	13	14	15	16	17
Total	23	34	25	24	25	24	18	19	23	29	27	24
38												1
39	1								1			1
40	2	2					1					2
41	2	2	1					1	1	3		
42	4	1	1				3	2		3	2	2
43	3	1	1			1	2	6	2	6	5	6
44	3	5	1	1			4	7	1	3	10	2
45	3	6	5		3	1	5	2	6	3	6	2
46	3	8	4	2	1	1	3		6	5	1	5
47	2	2	4	7	3	1			3	4	1	
48		3	3	2	3	5		1	2	1		1
49		2	3	4	9	4					1	2
50		2	1	2	3	3				1		
51				3	1	3						
52			1	1	1	3						
53					1	2						
54				2					1		1	

Appendix Table III. Volume of packed red cells (hematocrit) according to sex and age for Jewish children in high-income families in New York City.

Appendix Table IV. Red cell mean volume according to sex and age for Jewish children in high-income families in New York City.

Cubic Microns	Boys						Girls				
	Number at Each Age With Specified Finding						Number at Each Age With Specified Finding				
	12	13	14	15	16	17–18	12	13	14	15	16–17
Total	22	34	25	23	22	11	18	19	23	26	27
64		1									
67		1									
69–71	2		1								
72–74	3	10	1	1	1					1	
75–77	10	10	5	2	2		2	1	1		
78–80	4	4	6	3	3	1	3	5	3	6	1
81–83	2	6	5	4	1	1	8	2	3	1	5
84–86	1	1	4	5	7	2	2	6	7	7	7
87–89		1	1	4	2	5	2	1	4	7	3
90–92			1		4		1	2	2	3	6
93–95				1		1		1	2	1	4
96–98			1		2			1			1
99–101				1		1			1		
102				1							
108				1							

Micro-Micrograms	Boys						Girls				
	Number at Each Age With Specified Finding						Number at Each Age With Specified Finding				
	12	13	14	15	16	17–18	12	13	14	15	16–17
Total	22	34	25	23	22	11	18	19	23	26	27
20.0–20.9	1										
21.0–21.9	1	1									
22.0–22.9	2	4	2	1							
23.0–23.9	7	10	1	2	1				3	4	1
24.0–24.9	5	9	4	2	1	1	4	5	2	2	
25.0–25.9	5	7	5	6	7		5	6	5	5	6
26.0–26.9	1	1	8	3	4	5	6	1	8	7	6
27.0–27.9			5	6	6	1	2	2	3	7	4
28.0–28.9		2		1	1	2		2	1	1	8
29.0–29.9					2	1	1	3	1		1
30.0–30.9						1					1
31.0–31.9				1							
32.0–32.9											
33.0–33.9				1							

Appendix Table V. Mean hemoglobin content per cell according to sex and age for Jewish children in high-income families in New York City.

Appendix Table VI. Hemoglobin concentration in red cells according to sex and age for Jewish children in high-income families in New York City.

Grams Per Cent	Boys						Girls					
	Number at Each Age With Specified Finding						Number at Each Age With Specified Finding					
	12	13	14	15	16	17–18	12	13	14	15	16	17
Total	23	34	25	24	25	24	18	19	23	29	27	24
21											1	
25									1			
26									1			
27				1					1			
28					1				1			2
29			2	2	1	2		1	2	4	1	
30	7	6	2	2	6	6	3	3	4	7	6	7
31	8	7	6	11	6	9	5	8	10	16	11	5
32	4	14	6	7	8	5	7	5	2	1	7	5
33	3	5	5	1	3	1	3	2		1	1	3
34		1	2						1			1
35			1									1
36	1		1			1						
37		1										

CLASS BIRTH RATES IN ENGLAND AND WALES, 1921-1931

J. W. INNES[1]

WITH the publication of Part IIA of the Registrar-General's Decennial Supplement for 1931 it becomes possible to make a relatively up-to-date analysis of *trends* in class birth rates for all England. The complete recasting of the occupational census in 1921 precluded any comparison of birth-rate differentials in 1921 and 1911. It has meant that hitherto the demographer has had at his command direct data on English class fertility trends only for the early period covered by the famous 1911 Report on the Fertility of Marriage.[2] For the period since 1921, there have been various attempts to circumvent the lack of national data in England and elsewhere through official statistics and small sample studies of selected cities including London. The results of these inquiries have varied considerably with their locale but the variety of the answers has only added point to the perennial question raised by demographers for many years. Has there been any modification of the traditional strong association between higher status and lower fertility from class to class in modern communities? Has the association been weakened, destroyed, or even reversed? It is at last possible to bring direct, national data to bear on these problems for England during the period 1921 to 1931.

1921 AND 1931 CLASS BIRTH RATES UNADJUSTED FOR AGE DIFFERENCES

The same set of five class categories has been used in the social classification of births and married men under 55 in the 1921 and

[1] From the Department of Social Science, Columbia University.

[2] This situation led the present writer to attempt an indirect approach to the problem by means of birth rates for metropolitan districts, 1909-1934, *see* Innes, J. W.: CLASS FERTILITY TRENDS IN ENGLAND AND WALES 1876-1934. Princeton, Princeton University Press, 1938, pp. 70-118. *See also* Glass, D. V.: Fertility and Economic Status in London. *Eugenics Review*, July, 1938, pp. 117-124.

1931 Decennial Supplements. Class I is composed almost entirely of the members of the leading professions and of managers, officials, and independents in certain finance and insurance occupations. Employers and managers in mining, industry, transport and communication, retail and wholesale trade are included in Class II which also takes in the second grade of professionals, chiefly employees, and commercial employees in a few occupations carrying a measure of independence. Classes III, IV, and V correspond to the familiar classification of manual workers as skilled, semi-skilled, and unskilled, respectively. But Class III also includes salesmen and shop assistants in wholesale and retail trade as well as the great majority of clerical employees. Rather than lose the large and relatively distinctive group of clerical workers in the extremely inclusive Class III, they have been put in a sub-class, IIIA.[3] In the tables which follow, IIIA has been included in a second set of six class categories after the results for the five official, social classes have been presented.

In 1931 many minor changes in the occupational and social classifications were introduced. So far as possible these changes have been eliminated in the present analysis[4] and it is believed that the remaining differences in classification do not materially affect the comparability of the 1921 and 1931 results.

According to section A of Table 1, there were several outstanding changes from 1921 to 1931 in class fertility differentials. Class I was replaced by II as the class of lowest fertility. The absolute and relative differences in fertility between Class I and all other classes decreased. Class IV reduced its fertility differential even with respect to the new, least fertile Class II. The excess in fertility of Classes III and V over the least fertile Class I in 1921 and II in 1931, remained stable relatively but diminished absolutely. The trends measured by the 1921-1931 percentage decrease in birth rates

[3] *See* Appendix B for exact composition of Class IIIA.

[4] *See* Appendix B for detailed description of revisions made in official 1921 and 1931 classifications.

Social Class	Married Men Under 55		Births per 1,000 Married Men Under 55				
			1921		1931		Percentage Decrease 1921–1931
	1921	1931	Birth Rate	Ratio[1]	Birth Rate	Ratio[1]	
	A. FIVE SOCIAL CLASSES						
I	128,379	145,244	98	70	76	78	22
II	819,597	892,173	100	71	67	69	33
III	2,923,097	3,173,459	138	98	96	99	30
IV	1,030,092	1,022,317	164	116	106	109	35
V	796,898	980,982	174	123	122	126	30
Total	5,698,063	6,214,175	141	100	97	100	31
	B. SIX SOCIAL CLASSES						
I	128,379	145,244	98	70	76	78	22
II	790,045	841,107	102	72	69	71	32
IIIA	308,506	353,977	111	79	70	72	37
III	2,644,143	2,870,548	140	99	98	101	30
IV	1,030,092	1,022,317	162	116	106	109	35
V	796,898	980,982	174	123	122	126	30
Total	5,698,063	6,214,175	141	100	97	100	31

[1] Percentage of birth rate for total population.

Table 1. Unadjusted birth rates of (A) five social classes, 1921-1931 and (B) six social classes, 1921-1931, in England and Wales.

show that, as compared with the figures for the total population, the rate of decline was much smaller in Class I, considerably greater in Class IV, less in excess in Class II, and approximately the same in Classes III and V.

In the second section of Table 1, striking results for the "white-collar" class IIIA seem more than to justify its segregation from the classes among which it was distributed. Class III, from which most of the members of IIIA were drawn, was much more fertile than the new class in 1921, and still more in excess, in 1931, both absolutely and relatively. Moreover, the difference between the birth rates in 1921 of Classes IIIA and II had dwindled to insignificance in 1931, so that the two classes together comprise the sector of lowest fertility. Finally, in terms of rate of decline, Class

IIIA exceeds even Class IV, which showed the most rapid decrease of all five classes in the first part of the table.

Adjusted Class Birth Rates, 1921-1931

Comparisons between the class birth rates in Table 1 are rendered insecure to an unknown degree by the lack of any control over variations in ages of married women. In the absence of any class data on ages of wives, one is compelled to resort to average ages of husbands under 55 for an indirect index of variation in wives' ages which would affect class fertility differences. The use of this indirect approach is supported by the close association between husbands' and wives' ages but an element of uncertainty remains because there is apparently some variation in the relationship from class to class especially from I to II-V.[8]

The pattern of husbands' ages by social class in Table 2, with and without the separation of Class IIIA, is remarkably simple. In the first place, the proximity in age, on the one hand, of the first two classes, and on the other, of the remaining classes, is extremely

Table 2. Average ages of married men under 55, by social class in England and Wales, 1921-1931.[1]

Five Classes	Average Age		Six Classes	Average Age	
	1921	1931		1921	1931
I	41.3	41.5	I	41.3	41.5
II	41.4	41.5	II	41.5	41.6
III	38.8	38.8	IIIA	38.6	39.0
IV	38.8	38.8	III	38.8	38.8
V	39.2	38.9	IV	38.8	38.8
			V	39.2	38.9
Total	39.3	39.3	Total	39.3	39.3

[1] In calculating weighted averages for 1931, age categories 25–29 and 30–34 have been combined to correspond with the single 1921 category, 25–34.

[8] *See* Appendix A for a discussion of the problems raised by the use of age groups of husbands in birth rate analyses.

close. Secondly, all the class averages change either not at all or only insignificantly between 1921 and 1931 with the average for the whole population identical for the two years. As a consequence of these two facts, one may expect an adjustment for age differences to have more effect on the *levels* of fertility of the first two classes as compared with the other classes than on their respective fertility *trends.*

Direct standardization would be the most effective way to control these class differences in age but unfortunately the necessary age-specific birth rates are not obtainable. Partial correlation is a less precise but still defensible method for holding constant the influence of age on class birth rates.[6]

To carry out these correlations, series of birth rates, average ages of married men under 55, and class rankings have been constructed on the basis of fifty-six occupational categories, made comparable for 1921 and 1931.[7] These categories cover the entire population of gainfully occupied married men. In order to assign numerical values to the qualitative class categories the difference in status between adjacent classes has been taken as a unit of status. This means that the series of class ratings is rather crude and probably weakens the correlations in which status is a variable.

The detailed occupational birth rates in 1921 provide the basis for a 520-item[8] correlation analysis which can be used to check the results for the short series in 1921, and derivatively the results for the 1931 series.

The sharp reduction in the partial, linear correlation coefficient between birth rates and class ratings in the 1931 series as compared with either 1921 series is a first indication of a substantial weakening in the usual inverse relation between fertility and status. Be-

[6] Indirect standardization has been avoided here because of the intrinsic deficiencies of that method. *See* Yule, G. U.: On Some Points Relating to Vital Statistics. *Journal of the Royal Statistical Society,* 1934, xcvii, pp. 8-13; and Innes, J. W.: *op. cit.,* Appendix I, pp. 127-133.

[7] *See* Appendix C for construction of these series.

[8] *See* Appendix C.

cause of the crudeness of the status series, less significance inheres in the low *level* of the coefficients in both years than in their downward trend. Moreover the coefficient of zero in 1931 means only the absence of an overall linear relation, not necessarily the absence of any relation between class and fertility.

Table 3. Partial linear correlation and regression coefficients between birth rates, average ages of husbands under 55, and class status, in England and Wales, 1921 and 1931.

Coefficient	1921 526 Items	1921 56 Items	1931 56 Items
$r_{ba.s}$	−.30	−.31	+.002
$r_{ba.s}$	−.49	−.46	−.42
$r_{as.b}$	+.16	+.31	+.58
$b_{ba.s}$	−11.44	−10.81	−8.50

b—births per 1,000 husbands under 55; a—average age of husbands under 55; s—class status.

The second and third rows of coefficients reveal that variation in ages of married men has a definite, consistent association with variation in birth rates and an equally strong but more fluctuating relation to differences in status. These two relations make self-evident the importance of controlling age in birth rate comparisons between classes.

The partial regression coefficients in Table 3 measure the average reduction in each series of birth rates associated with a one year increase in age of married men under 55. Using the coefficients for the two 56-item series as "correction factors" in 1921 and 1931, the average ages for all classes have been equated to the average for the total population and their respective birth rates changed proportionately.

Two general effects on the class birth rates of these adjustments for age differences are immediately clear when Table 4A-4B and Figure 1A-1B are compared with Table 1A-1B. Class differences in fertility and the comparative *levels* of class fertility trends are greatly altered while the *directions* of the trends, the percentage decreases are only slightly changed.

In 1921, age adjustments have little effect on the small difference between Class I and II birth rates but greatly reduce the absolute

and relative spread in fertility between these classes and III, IV, and V. In 1931, this narrowing of the range in fertility between Classes I-II and III-V by controlling the age factor is carried still further. According to the age-corrected rates in contrast to the uncorrected rates, the ratio of decline of even Class II fertility is not greater but slightly less than the relative decreases in Classes III and V and lags much more behind Class IV's fertility decline. In the case of Class I, the rate of fertility decline is again very much slower than the rates for all other classes but now its trend line (Figure 2A) is crossed by Class III's in addition to Class II's. Thus the 1931 adjusted rates show not only that the displacement of I by II as the class of lowest fertility is not to be explained away by

Table 4. Adjusted[1] birth rates in (A) five social classes, 1921-1931 and (B) six social classes, 1921-1931 in England and Wales.

Social Class	Births per 1,000 Married Men Under 55				
	1921		1931		Percentage Decrease 1921–1931
	Birth Rate	Ratio[2]	Birth Rate	Ratio[2]	
	A. Five Social Classes				
I	120	85	95	98	21
II	123	87	86	89	30
III	133	94	92	95	31
IV	159	113	102	105	36
V	173	123	119	123	31
Total	141	100	97	100	31
	B. Six Social Classes				
I	120	85	95	98	21
II	126	89	89	92	29
IIIA	103	73	67	69	35
III	135	96	94	97	30
IV	159	113	102	105	36
V	173	123	119	123	31
Total	141	100	97	100	31

[1] Adjusted to an average age of married men under 55 of 39.3, the actual average for total population in 1921 and 1931.
[2] Percentage of birth rate for total population.

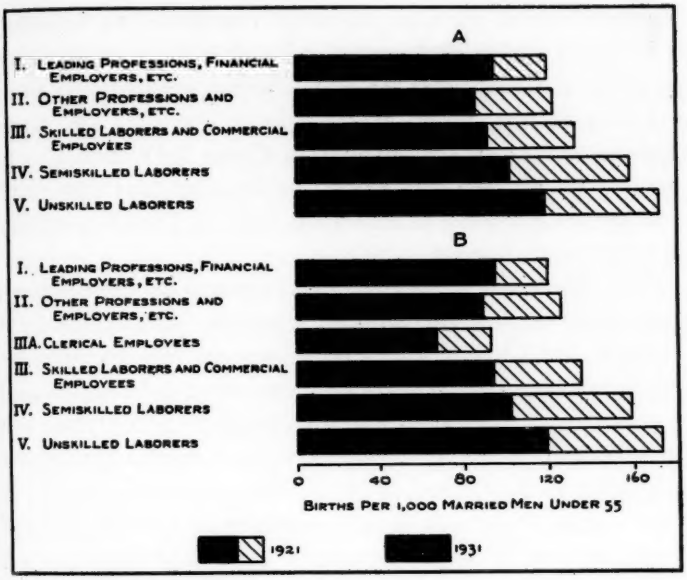

Fig. 1. Birth rates by social class, adjusted for age, in England and Wales, 1921-1931.

changes in age composition but also that Class III's birth rate has dropped down to a level slightly below that of Class I. The fertility decline of Class IV continues to be decidedly the most rapid of all classes from 1921 to 1931.[9]

One might sum up the differential fertility situation in 1931, as compared with 1921, by saying that the usual decrease in relative fertility with rise in status, still true in 1921, has increased from Class V to IV, has been much reduced from Class IV up to Class II and replaced by an increase from Class II to Class I. These changes help to explain the 1921-1931 decrease in the partial correlation coefficient between fertility and status. Turning from the ratios of

[9] This is an interesting confirmation of a principal result of the writer's previous study which showed that London's Area-Class IV, a group of districts with a population most analogous to England's semi-skilled Class IV, had the most rapid birth-rate decline of all area-classes, from 1922-1924 to 1931-1933. *Op. cit.*, p. 117.

class birth rates to the total population's birth rate, to the actual birth rates in Table 4, diagrammed in Figure 1, then even the excess in fertility of Class V over the other classes is substantially less in 1931 than in 1921, except with respect to Class IV. The closer approximation of the fertility levels of Classes II-IV from 1921 to 1931 is, of course, even more marked in the actual rates than in the ratios while the reversal of the fertility order of I and II is equally prominent in both series.

These differential fertility and trend patterns for the five main social classes are little altered by the separation of Class IIIA from Classes II and III. The latter's birth rates and fertility ratios are slightly raised and the corresponding percentage decreases reduced by one point but these do not suffice to change the rank of these two classes in the fertility order of all five classes nor to alter significantly their place in the pattern of trends. The outstanding results in Table 4B and Figures 1B and 2B pertain to the fertility record of Class IIIA itself. In 1921 corrections for age change IIIA's position from third least fertile class to much the most infertile class of all. This position is maintained in 1931 for the downward trend of IIIA's birth rate approximates that of IV, the class of most rapidly declining fertility. Class IIIA, therefore, does not conform to the tendency of the other infertile Classes II and especially I, to have the lower 1921-1931 rates of fertility decline. Inferentially, this preponderantly white-collar class must be characterized by situations and attitudes exceptionally unfavorable to fertility.

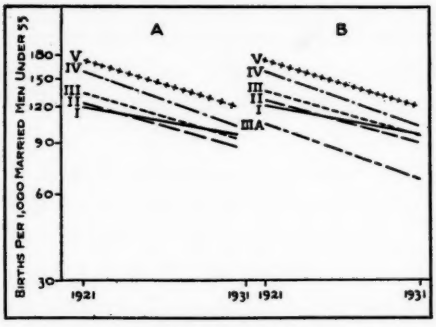

Fig. 2. Trends in adjusted birth rates by social class in England and Wales, 1921-1931.

Birth Rates and Fertility Trends in Selected Sub-Classes and Occupations

Both the very distinctive fertility behavior of Class IIIA in addition to the broad heterogeneous character of the five main classes, especially I-III, encourage the study of birth rates by component sub-classes and selected occupations. The birth rates of distinct groups within Classes I and II in Table 5 and Figure 3 constitute a valuable supplement to the general rates and trends of those two classes.

It is open to question whether the leading professions and certain groups of businessmen should be combined to form a single top class. Doubt may justifiably be raised as to whether any profession is at the top of the socio-economic scale and in any case, differences in mode of work, situation, tradition, etc., suggest that separate treatment is appropriate for each of these two groups in demographic or other analyses. This suggestion is borne out by

Table 5. Unadjusted birth rates, average ages of married men under 55, and adjusted[1] birth rates in sub-classes and occupations of social classes I and II in England and Wales, 1921-1931.

Sub-Class or Occupation	Unadjusted Birth Rate		Average Age		Adjusted[1] Birth Rate		Per Cent Decrease 1921–1931
	1921	1931	1921	1931	1921	1931	
Professions, I	110	86	41.0	41.2	128	102	20
Professions, II	87	66	40.4	40.8	99	79	20
Employers, etc., I	74	59	41.9	41.8	102	80	21
Employers, etc., II							
Mining	77	45	42.0	43.0	106	76	28
Manufacturing	98	68	41.8	42.5	125	95	24
Transport and Communication	92	66	42.5	43.5	127	102	20
Retail and Wholesale Trade	104	67	41.4	41.3	127	84	34
Agriculture	131	92	41.5	41.5	155	111	28
Other Business Occupations, II	84	57	41.7	41.7	110	77	30

[1] Adjusted to average age of married men under 55 in total population (39.3).

the results in Table 5 pertaining to Class I Professions[10] and Class I Employers, Managers, etc., chiefly in finance and insurance.[11] Although the fertility trends of these two sub-classes are almost identical, the financial group's slow rate of decline, relatively to other classes' rates, took place at a much lower level than the same rate for the professional group. Since the fertility of this financial sub-class is still lower than Class II's in 1931, the responsibility for the reversal of the usual Class I-II order of increasing fertility is, in a sense, confined to Class I's professional constituent. If the financial group may be considered to have higher status than the leading professions, then the results evidence a stabilized, *inverse* relation between fertility and status *within* Class I.

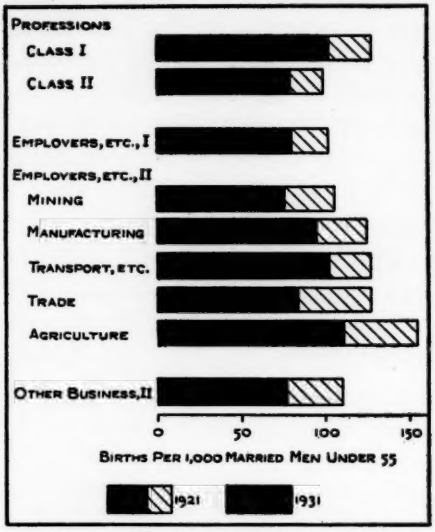

Fig. 3. Adjusted birth rates in sub-divisions of Classes I and II in England and Wales, 1921-1931.

Quite a different picture of status-fertility relations is presented when one shifts to the professional sub-class of Class II[12] for comparison with Class I Professionals. Again the 1921-1931 trends are the same, but in this case, there is stabilization of a *direct* association

[10] Occupations 690-1, 810, 812, 814, 820, 826, 830-1, 840-1, 860-5, 868-70 in 1921; 760, 762, 764, 770, 772, 780-1, 790-1, 810-5, 818-20 in 1931.

[11] Occupations 710, 730, 739, 790-3, 796, 829, 882, 930 in 1921; 610, 630, 640, 730-4, 736, 832, 880 in 1931.

[12] Occupations 827, 842, 849-51, 866, 871-5, 879 in 1921; 773, 792, 799, 800-1, 816, 821-5, 829 in 1931.

between class-status and fertility within comparable occupational fields. This is possibly one of the earliest reversals of the usual inverse status-fertility relationship if one may judge by the roughly analogous data from the 1911 Census Report on the Fertility of Marriage[13] which show no diminution of the inverse relation up to the end of the nineteenth century. On the other hand, for the present period, 1921-1931, the relatively slow decline in this group of Class II Professionals only worked against the general trend of its class in the direction of a lower birth rate than Class I.

The great majority of the persons in Class II is comprised not of the second grade of professions, but of various groups of employers, managers, officials, etc. It is among these that one must look for a more specific characterization of the sub-class or sub-classes primarily responsible for a Class II birth rate lower than Class I's. Moreover, they supply interesting comparisons with the group of employers, etc., who were ranked as Class I.

The Class II groups may perhaps be approximately arranged in order of status and their fertility differences judged in the light of this arrangement. In view of the presence of a large percentage of owners, in a semi-rentier position, the employers, managers, etc., in mining[14] have probably the highest economic position. Of the other four groups, it seems fairly safe to consider employers, etc., in manufacturing[15] and in transportation and communication[16] as groups with higher status than those in retail and wholesale trade,[17] residual business occupations[18] (chiefly agents, buyers, commercial

[13] Writer's previous study, *op. cit.*, pp. 55-64.

[14] Occupations 040, 050, 070, 077 in 1921; 040, 050, 060 in 1931.

[15] Occupations 080, 090, 100, 120, 140, 150, 160, 280, 300, 320, 330, 340, 350, 400, 430, 450, 460, 470, 500, 510, 520, 550, 560, 590, 600, 610, 630, 640, 650, 660, 680, 960 in 1921; 070, 080, 090, 100, 110, 120, 130, 240, 250, 270, 280, 290, 300, 340, 370, 380, 390, 410, 460, 480, 500, 520, 530, 540, 550, 560, 570, 580, 910 in 1931.

[16] Occupations 700, 731-3, 750 in 1921; 590, 611, 631-3, 650 in 1931.

[17] Occupations 711-2, 770 in 1921; 612, 670-85, 686, 689 in 1931.

[18] Occupations 010, 014, 562, 752, 771-3, 779, 797, 799, 880-1, 884, 912-4 in 1921; 010, 014, 482, 652, 690-2, 723, 737, 739, 830-1, 834, 862-4 in 1931.

travelers, innkeepers, publicans), and farming.[19] Certainly the last three contain a much larger proportion of "small businessmen" than the other two.

If this informal ordering by status is followed, there was in 1921 a considerable correspondence between high status and low fertility among businessmen not only for Class I compared with Class II sub-classes but also among the latter groups, with those labeled "Residual Business Occupations" as the only substantial exception. It suggests that this exception contained a large representation of occupations analogous to the outstandingly infertile white-collar Class IIIA. By 1931, several changes in the 1921 inverse status-fertility relationship came into view. With the exception of the small group of owners, managers, etc., in mining, it is the lower status groups of business employers, etc., whose birth rates declined most from 1921 to 1931. Retailers and wholesalers, followed by those in "Residual Business Occupations" and farmers, in that order, had relative fertility decreases which considerably exceeded those in the manufacturing, transport and communication groups in Class II and the finance and insurance sector of Class I. Indeed, the decline of the retailers and wholesalers' birth rate was so sharp as to come within one point of the percentage decrease in Class IIIA's fertility. The net outcome in terms of 1931 differentials is an approximation to the very low fertility level of Class I employers, etc., on the part of retailers and wholesalers and an even lower fertility in the case of "Residual Business Occupations." Both these lower status groups are markedly less fertile than the higher status manufacturing, transport and communication sub-classes in 1931. Only farmers remain more fertile than the latter sub-classes but they have appreciably narrowed the differential. Of all the sub-classes of employers, the high status group, mine owners, etc., have become the least fertile and this is possibly due to the rentier situation of many of its members, a situation well-known to be unfavorable to

[19] Occupations 011-2 in 1921; 011-2 in 1931.

fertility. Yet the predominant feature of the changes in fertility differentials for the various groups of business employers, managers, etc., for the period 1921-1931 is the transition from an association of higher status to one of lower status with infertility.

Besides the sub-classes of Classes I and II, there are several groups of occupations in the same fields of work which have in the past revealed fertility patterns sufficiently distinctive to merit separate analysis. Retail and wholesale trade constitutes a numerically important sector of the gainfully occupied and its managerial, employer, and independent component has been found to be a striking instance of a low birth rate associated with relatively low status in comparison to other groups of employers. But when their birth rates and trends are compared with those of their own employees, primarily salesmen and shop assistants,[20] a very different situation is found. In 1921, the birth rate of shop assistants was appreciably lower than that of the employers and independents in "trade," and indeed not much greater than the birth rate of the clerical sub-class, IIIA. However, the 1921-1931 birth rate trends of salesmen, etc., and retail and wholesale employers, etc., follow the long familiar pattern of higher status and sharper fertility decline so that by 1931 there is practically no difference between these two groups' birth rates and the difference in fertility between shop assistants and Class IIIA has been much increased. It is quite possible that the social and economic circumstances of shopkeepers and wholesalers were peculiarly inhibitive of fertility during this period. However, it may also be that a heavy recruitment of their salesmen from children of manual workers' families is responsible for the disappearance of the direct relation between status and fertility in this line of business from 1921 to 1931. Certainly the limited evidence available indicates that commercial employees of working-class origins are more fertile than those who come from other urban classes[21] and

[20] Occupations 775 in 1921; 700-17, 719 in 1931.

[21] *See* Gewerkschaftsbund der Angestellten: The Salaried Employee in his Economic

(Continued on page 86)

retail trade is a channel of less difficult transition from manual to white-collar work.

One class of workers, agricultural laborers,[28] considered sufficiently distinctive as to their fertility to be separately analyzed in the 1911 Census Report by the late T. H. C. Stevenson offers an interesting and relevant birth rate comparison with another low status Class II component, farmers. A close similarity here appears to the differential fertility position of retailers, wholesalers, etc., and salesmen and shop assistants. Agricultural laborers had approximately the same fertility as farmers in 1921. They resemble salesmen and shop assistants in that their 1921-1931 birth rate decline was less than that of the employer group in the same industry. Consequently, by 1931, agricultural laborers are again distinctly more fertile than farmers. But it is hard to conceive of any selective factor which may have affected the birth rate of agricultural laborers in the same way that the probable movement of manual workers' descendants tended to influence the fertility of retail sales clerks, etc. Thus we are compelled to regard the decade 1921-1931 as peculiarly unfavorable to the fertility of the small independents who predominate in agriculture. During that period, the two subclasses of farmers and agricultural laborers again showed the same association of greater decline in birth rate with higher status that they had exhibited in the data of the 1911 Census Report but which had apparently been eliminated by 1921.

The other two industries which supplied special classes for the fertility analyses in the 1911 Report on the Fertility of Marriage were textiles and mining. In both cases, the data in Table 6 and Figure 4 provide a basis for determining whether their earlier fertility trends have continued to set them apart from their corresponding general social classes. In the 1911 Report, textile operatives were

and Social Development, pp. 26-27. (Translation by A. Lissance, published in 1938 under the auspices of the Works Progress Administration with the cooperation of the Department of Social Science, Columbia University.)

[28] Occupations 020, 022-4 in 1921; 020-3 in 1931.

much the least fertile of the six working class categories for which completed fertility rates were calculated. The 1921 birth rates of both the Class III[23] and Class IV[24] groups of textile workers also show them to be considerably less fertile than their corresponding general classes. This comparative infertility is only accentuated in 1931 for the birth rates of both classes of textile workers declined more sharply than either the Class III or the Class IV birth rates and also more rapidly than the birth rate of their own employers, managers, etc. By 1931, they supply a conspicuous illustration of *direct* association of infertility with low status for they have birth rates not

Table 6. Unadjusted birth rates, average ages of married men under 55, and adjusted[1] birth rates for selected industrial groups by social classes in England and Wales, 1921-1931.

Industrial Group	Unadjusted Birth Rate		Average Age		Adjusted[1] Birth Rate		Per Cent Decrease 1921-1931
	1921	1931	1921	1931	1921	1931	
Retail and Wholesale Trade							
Employers, etc., II	104	67	41.4	41.3	127	84	34
Salesmen and Shop Assistants, III	129	104	37.5	36.8	110	83	25
Agriculture							
Farmers, etc., II	131	92	41.5	41.5	155	111	28
Agricultural Laborers, etc., IV	154	127	39.6	38.9	157	124	21
Textiles							
Class II	67	54	42.2	42.6	98	82	16
Class III	102	66	39.5	39.1	104	64	38
Class IV	138	85	39.0	38.4	135	77	43
Classes III, IV	112	72	39.4	38.9	113	69	39
Mining							
Class II	77	45	42.0	43.0	106	76	28
Class III	193	134	37.5	38.4	174	126	28
Class IV	214	107	38.0	38.6	200	101	50
Class V	161	90	38.8	38.2	156	81	48
Classes III, IV, V	199	124	37.7	38.5	182	117	36

[1] Adjusted to average age of married men in total population (39.3).

[23] Occupations 351-61, 365, 367-71, 374-9, 382-3, 385, 396-8 in 1921; 301-11, 315, 317-20, 322-6, 330-1, 337-8 in 1931.

[24] Occupations 362-4, 366, 372-3, 380-1, 384 in 1921; 312-4, 316, 321, 327-9, 332 in 1931.

only lower than that of their own employers, etc.,[35] but also lower than those of the general Classes I and II. Indeed, the skilled group's rate is less than even the birth rate of the outstandingly infertile white-collar class IIIA while the semi-skilled's birth rate is only ten points higher. Semi-skilled textile operatives follow the general pattern of Class IV's fertility decline in that they too reduced the relative fertility differential between them and the skilled sector.

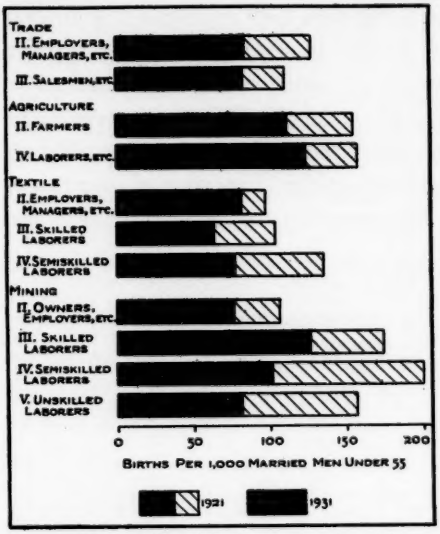

Fig. 4. Adjusted birth rates in selected industrial groups in England and Wales, 1921-1931.

At the opposite extreme from textile workers, the 1911 Report showed miners to have the highest and most slowly declining fertility of all the special and general classes. This statement holds partially true for the birth rate of the skilled group of miners,[36] since it was higher in 1921 and 1931 than any general class birth rate and than either textile workers' or agricultural workers' birth rates, yet its 1921-1931 decrease was very little different from Class III's and distinctly greater than the relative decline in agricultural laborers' fertility. On the other hand, the relative decreases in the birth rates of the semi-skilled[37] and unskilled[38] in mining far exceed the declines, respectively, in Class IV and Class V birth rates. In

[35] Occupation 350 in 1921; 300 in 1931.
[36] Occupations 041-2, 051, 054, 071, 078 in 1921; 041-2, 051, 054, 061 in 1931.
[37] Occupations 043-4, 047, 049, 056, 072-3, 076, 079 in 1921; 043-4, 047, 049, 056, 062-3, 069 in 1931.
[38] Occupation 074 in 1921; 064 in 1931.

1921 the unskilled workers in mining were appreciably less fertile than Class V and by 1931 this differential was much increased. Semi-skilled mine workers had still a much higher birth rate than Class IV but in 1931 this large difference had been wiped out. Comparing the three classes of mine workers, the status-fertility association was inconsistent in 1921 in that it was inverse for Classes III and IV but direct when these two groups are compared with Class V. In 1931, mine workers constituted a very thorough embodiment of a direct relation of fertility to social status *within the working class.* Although the birth rate of skilled miners decreased no more rapidly than that of their employers, managers, etc., for 1921-1931, so much greater were the decreases for the semi-skilled and unskilled that the differential between the employers' and workers' birth rates was decidedly reduced.

Summary

1. Class birth rates, unadjusted for age variation, show that in 1921 the usual inverse relation between status and marital fertility still held but Class II was only slightly more fertile than Class I. On the other hand, by 1931 the birth rates in Class II and in IIIA, a special white-collar class, were definitely lower than that of Class I. Also analogously to fertility trends in London area-classes, the birth rate declined in Class IV more rapidly than in any other general class.

2. Substantial and stable differences in average ages of married men under 55 between Classes I-II and III-V impair the value of unadjusted birth rates as indices of class differentials in 1921 and 1931.

3. According to birth rates "adjusted" to eliminate the effects of age differences, the reversal in 1931 of the 1921 inverse status-fertility association for Classes I and II is not eliminated by age adjustment. On the other hand, the adjusted birth rates for IIIA place it as the least fertile class even in 1921 and by reason of its

sharp 1921-1931 decline, it is even more conspicuously the class of relatively lowest fertility in 1931. Again, Class IV is the class of most rapid decrease in fertility from 1921 to 1931.

4. Cross-classification of fertility and occupational data by class and general type of work or industry brought out a variety of status-fertility relations and changes therein for 1921-1931. (a) Class I and II professionals showed a stable *direct* relation between fertility rates and status for the period. (b) Class I employers, managers, etc. (chiefly finance and insurance) had birth rates for the entire period much lower than those for Class I professionals, but these declined less rapidly than the birth rates of the lower status groups —retailers and wholesalers, miscellaneous Class II business occupations, and farmers for 1921-1931. Of these last three groups, all but farmers had become less fertile by 1931, in contrast to 1921, than the presumably "bigger business" group in manufacturing, transportation and communication. Hence, an inverse relation between class status birth rates was in good part replaced by a direct relation within Class II. (c) Proprietors, managers, etc., in retail and wholesale trade had a greater birth rate decline than salesmen and shop assistants so that the 1921 direct association of status with fertility in this socio-economic sector was no longer present in 1931. (d) An inverse fertility differential between farmers and agricultural laborers, absent in 1921, was re-introduced in 1931. (e) Textile workers, both skilled and semi-skilled, outstanding with respect to the low level and the sharp decline of their birth rates, became less fertile than their own employers in 1931 and joined Class IIIA as the least fertile groups investigated. (f) Only skilled miners remained more fertile than their general class in 1931 while the birth rate of unskilled mine workers was already less fertile than Class V in 1921. Both semi-skilled and unskilled mine workers' birth rates had exceptionally drastic decreases, *circa* 50 per cent, from 1921 to 1931.

APPENDIX

A. Birth Rates for Married Men and Age Adjustments

The 1931 as well as the 1921 occupational fertility tables are weakened by making 1,000 husbands, not wives, the base in the calculation of birth rates. The fragmentary evidence available[1] indicates that the average excess in ages of husbands over ages of wives is not approximately the same for all classes. Although it is not clear that this age gap varies appreciably for Classes II to V (1911 Classification), it does appear to be true that in the highest class, husbands are older than wives by two or three years more than they are in the other four classes. This situation raises the difficulty that any process of adjustment of husbands' ages to a common norm, by standardization or correlation, is likely to mean over-compensation in the case of Class I. In effect, the ages of wives in this class are probably made lower than the norm for the population.

Unless the atypically large excess of Class I husbands' over wives' ages fluctuates appreciably within a decade, it should not be so damaging to a study of 1921-1931 birth rate trends as to an analysis of cross-section differences in either year taken alone. If this factor operates as a constant bias, it can affect changes in the birth rates only if there are markedly different rates of fertility decline in populations differing by only two or three years in average age of mothers. The trend picture would still not be as distorted by a constant as by a changing bias. There is lacking any evidence to determine the stability of the large age discrepancy between husbands and wives in Class I for 1921-1931 or even 1911-1921. It is possible that this discrepancy was less serious in 1921 and 1931 than in 1911. Moreover, it has already been noted that the limited 1911 data indicate no comparable distortion of birth rate differences between Classes II, III, IV, and V.

B. Official Occupation and Class Distributions, 1921-1931

The classificatory changes which were introduced in 1931 are comprised of (1) alterations in the 1921 denotation and classification of occupations effected in the 1931 Census and (2) shifts from 1921 to 1931 in the class status attributed to certain occupations in the Registrar-General's Decennial Supplements. Obviously the latter have an immediate bearing on class fertility trends. It might seem that the former have significance only where a transfer

[1] *See* Fertility of Marriage. Census of England and Wales, 1911, xiii, pp. xiv-xix, xxvii-xxviii; also The Registrar-General's Decennial Supplement for England and Wales, 1921, pp. xcvii-xcviii.

from one social class to another is made. This is quite true in so far as one is interested only in the fertility trends of broad social classes. Yet it is valuable to group occupations into sub-classes or restricted occupational categories for the further analysis of birth-rate changes. Then it is necessary to cope with as many specific occupational changes as possible whether or not they are tied up with transfers between social classes. To delimit and arrange specific occupations and fix their class status comparably for 1921 and 1931, the 1931 official treatment has been used as the standard wherever feasible.

The changes in the classification of occupations introduced in 1931 are listed in detail in the 1931 Census volume Occupation Tables.[2] They can be divided into three groups—(a) separations in 1931 of occupations which were combined in 1921, (b) combinations in 1931 of occupations which were separately tabulated in 1921, (c) shifts of sub-occupations from one occupation in 1921 to another in 1931. For the most part it is impossible to calculate birth rates for 1931 occupations recombined for comparability with 1921 rates because there is no tabulation of births by specific occupations in Part IIA of the 1931 Registrar-General's Decennial Supplement. At any rate, of the additional categories introduced by changes of type (a) there are very few of quantitative importance which have status ratings different from those of 1921.

In some cases it is possible to solve by means of estimates the problem presented by the changes of type (a). Table I in the 1931 Decennial Supplement supplies, with a great many omissions, statistics classified by father's occupation on deaths under one year for legitimate children born 1930-1932 and on annual infant mortality per 1,000 legitimate live births in 1931.[3] Where such data are given, total births can be estimated and corresponding occupational birth rates calculated. This procedure has been followed in the case of locomotive engine firemen and cleaners who were combined with other Class III occupations in 1921 but separately tabulated and rated IV in 1931.

The second type of changes, from separate categories in 1921 to combined categories in 1931 are much more readily handled according to the plan to use the 1931 classification as standard. By means of the occupational statistics in the 1921 Decennial Supplement,[4] the 1931 combinations of specific occupations can be duplicated for 1921. Usually the various 1921 occupations combined in 1931 fall within single Occupation Orders but where they do not,

[2] *Op. cit.*, pp. 673-680.

[3] *Op. cit.*, pp. 191-210.

[4] *Op. cit.*, pp. ciii-civ.

the Order to which they have been allocated in 1931 has been followed.[6] In addition, single occupations have been transferred from one 1921 Occupation Order to another in line with changes made in the 1931 classification.[8]

In the case of the third type of occupational rearrangement where sub-occupations have been placed in different occupations in 1921 and 1931, it is impossible to reconstruct the occupations on the same basis for both years since there are no sub-occupational data. One might resort to the makeshift of combining the occupations between which sub-occupational transfers have been made. This makeshift is ordinarily to be avoided because it over-rides occupational and sometimes class differences between large groups of individuals. However, despite its objectionable character, it has been necessary to follow this procedure in the case of one highly important sub-occupational category, viz., Civil Service and Local Authority Clerks.[7]

When all feasible adjustments[8] of the differences between the 1921 and 1931 specific occupational classifications have been made, there remains the less difficult problem presented by the 1931 official revisions in the social classification of occupations. To meet this problem, the 1921 official statistics for births and married men under 55 by social class have been recalculated as far as possible on the basis of the 1931 social classification of occupations. Thus fifty-three occupations were transferred from one social class to another in the 1921 tabulations.[9] On the other hand, four 1931 occupations which had been

[6] Where occupations are drawn from different Orders, the Order to which they have been assigned is indicated in brackets after the 1921 Code Number of the last constituent occupations. The combinations made are 016, 027; 017, 021; 018, 026, 039; 070, 077; 071, 078; 076, 079; 088, 693 (IV); 089, 099, 119, 139, 149, 159, 279, 299, 319, 329, 339, 349, 399, 429, 449, 459, 469, 499, 509, 519, 549, 559, 599, 609, 619, 639, 649, 659, 669, 689, 699, (XXXI); 109, 110; 126, 127, 138; 170, 171, 173; 240, 251; 261, 267, 278; 305, 306, 307, 310, 311; 324, 325, 328; 366, 372; 367, 371; 377, 398; 396, 558 (XVIC); 436, 448; 454, 458; 475, 476; 504, 508; 532, 534; 535, 536; 537, 538; 563, 571, 588; 572, 574, 575; 578, 581, 589; 592, 593, 598; 613, 618, 682, 683; 692, 961 (XXXI); 698, 965, 966, 989 (XXXI); 714, 716; 715, 725; 717, 729; 742, 749; 789, 889 (XXVI); 794, 795; 829, 930 (XXVIII).

[8] The following transfers of occupations by Code Number have been made: 107, 108 from V to XVIII; 259 from VII to XXXI; 382, 383 from XII to XVIB; 478 from XV to XVIII.

[7] *See infra,* pp. 20-21.

[8] In addition to the changes already described, two occupations (Nos. 821 and 987) had to be omitted from the 1921 tabulations. Moreover, births for five managerial occupations (Nos. 410, 430, 440, 450, 460) were not included in Table 14A of the 1931 Decennial Supplement. Estimated births of 724 and 424 were added for occupations 410 and 460, but since not even estimates could be made for 430, 440, and 450, they had to be dropped from the 1931 tabulations of husbands under 55.

[9] By class and code number, these transfers were: from I to II, 752; II to I, 691, 882; II to III, 017, 563, 713, 714, 734, 789, 828, 911, 939; III to II, 849; III to IV, 018, 076, 118,

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sub-occupations with a different social status in 1921, were reallocated back to the social classes which had included them in the earlier year,[20] for it was possible to estimate the number of births which were involved.

Government Clerks and Class IIIA

Combination of Civil Service and Local Authority Clerks with their respective groups of officials in 1921 and with "Other Clerks" in 1931 presents a serious problem further complicated by the gaps in the 1931 data from which estimates of births can be made. Broadly, *two* semi-solutions of this problem have been used in this analysis.

The first way to meet the difficulty in part is to preserve the five-fold social classification even at the cost of giving to certain occupations class *loci* different from their official rankings in 1921 and 1931. When Civil Service and Local Authority Clerks were transferred in 1931 from Public Administration to Clerks and Draughtsmen they were placed in Class III instead of Class II. Class III is therefore the only available category to which one can assign the occupations with which they were combined in 1921 and from which they were separated in 1931. In addition to these occupations, Police Chief Constables, Inspectors and Superintendents had also to be placed in Class III instead of II in both years because of deficiencies in the 1931 birth data. Revision in status from II to III affected three government occupations in 1921 and four in 1931.[21]

The second solution avoids the inclusion in Class III of a sizeable Class II group (27,980 husbands under 55 in 1931) by means of the predominantly clerical sub-class, IIIA.[22] In creating Class IIIA, it is possible to combine with the Class III and Class II constituents of Clerks and Draughtsmen, the government occupations transferred to Class III by the first method. Thus these occupations are included in a relatively homogeneous "white-collar" class, not in the already heterogeneous Class III.

384, 434, 705, 715, 774; IV to III, 021, 027, 236, 580, 588, 889, 954; IV to V, 229, 319, 329, 339, 349, 399, 429, 449, 459, 469, 549, 559, 578, 589, 609, 619, 639, 649, 689, 706, 922, 942; V to IV, 079, 965, 966. This list includes all changes in social status which were involved in the combinations of separate occupations described in footnote 5.

[20] From II to III, 015; IV to III, 593, 594; IV to V, 355.

[21] By code number these occupations are 800, 805, 808 in 1921 and 740, 742, 743, 750 in 1931. One new 1931 category "Other Civil Service," was already transferred to Class III in the official classification.

[22] Class IIIA combines occupations numbered 800, 805, 808, 931-3, 939 in 1921; 740-3, 750, 881-4, 889 in 1931.

C. Construction of Correlation Series in 1921 and 1931

The chief reason why only 56-item series can be utilized in the 1931 correlations is the absence of a tabulation of births by specific occupation of father in that year. By means of the material in the Decennial Supplement's Table 14 on births a series of birth rates can be calculated for occupations grouped by occupation order and social class. As published this would yield a series of eighty-five items by combining Table 14 with the totals of married men under 55 in the Occupations Census. But it is first necessary to effect the additions, subtractions, and transfers already employed in the calculation of unadjusted class birth rates. Furthermore, it is highly advisable to combine small categories with extraordinarily high or low birth rates with larger categories in Table 14 in order to avoid the distortion of coefficients by a few extreme variants of little quantitative consequence in the total population. In making such combinations, cognate occupations have been chosen so far as it has been feasible. Moreover, the number of items for each social class has been kept very roughly in line with its quantitative importance in the population, with the unavoidable exception of Class I occupations. In none of these combinations has any category been transferred from one class to another. The net result of these rearrangements is to replace the original 85-item series with a more defensible 56-item series,[23] still large enough to sustain a three-variable correlation analysis.

Whatever biases may have been introduced in the compilation of the 1931 series should, at least, be made constant by a maximal duplication of the 1931 grouping in drawing up the 1921 classification. For the most part, by incorporating the changes described in connection with the computation of

[23] Both in the following list for 1931, as well as in the corresponding 1921 grouping under each social class, from I to V, any occupational category used is designated by the official occupation order, from I to XXXI, and, where necessary, by the occupation sub-order, from A to D, if the category includes all the specific occupations of a given class in the occupation order or sub-order. Where an occupational category covers only a selection of occupations among any of its constituent orders or sub-orders, or where an occupation has been transferred from another order, these occupations are listed by code number. Class I—XXII and XXIII; XXIVB and XXXI; XXV (770-2); XXV (780-1, 810-5, 818-20); XXV (790-1); XXVI and XXVIII; Class II—II; III-VII; VIII-XII, XX, XXI, and XXXI; XIII; XIVA, C, D; XIVB, XVA, and XVII; XVIII and XIX; XXII, XXIII, and XXVI; XXV (773, 792, 799, 816, 821-5, 829); XXV (800-1); XXVII; XXVIII; Class III—II; III; IV-VII; VIII-X; XI, XX, and XXI; XII; XIII; XIV; XV and XVI; XVII; XVIII and XIX; XXIIA; XXIIB, C, D; XVIII and XXIVB; XXIVA; XXV and XXVI; XXVII; XXVIII; XXIX; XXX; XXXI; Class IV—I and II; III; IV, V, VII, and IX; XII and XIII; XIV-XVII; XVIII and XIX; XXIIA and XXIII; XXIIB, C, D and XXIV; XXVII; XXIX; XXX; XXXI; Class V—II, III, XXVII, XXIX and XXXI (913, 918, 950); VII, XIII, and XXXI (920, 930, 940); XVII; XXII; XXIII.

general class birth rates, it has been possible to achieve this comparability of 1921's 56-item[14] series with the 1931 series.

The 526-item series which served to check the 56-item correlations for 1921, were drawn from the 602 specific occupations for which births and birth rates were tabulated in the 1921 Decennial Supplement. The excluded entries[15] were comprised with few exceptions of occupations with birth rates so improbable that it seemed very likely that many married men under 55 who had been entered in those occupations at the Census, had been excluded from them at the time of birth registrations. The remaining omissions were due to advisable combinations.[16]

[14] Class I—XXI (690-1) and XXV (830-1, 860-5, 868-70); XXII and XXIII; XXIVB and XXXI; XXV (820, 826); XXV (829), XXVI and XXVIII; XXV (840-1); Class II—II (010-2, 014); III-VII; VIII-XII, XIX, XX, and XXXI; XIII; XIVA, C; XIVB, XV, and XVI; XVII, XVIII; XXII, XXIII, and XXVI; XXV (827, 842, 849, 866, 871-5, 879); XXV (850-1); XXVII; XXVIII; Class III—II (013, 015-7, 021, 027); III; IV-VII (excl. 107-8); V (107-8), XV (478), XVII and XVIII; VIII-X; XI, XIX, and XX; XII (excl. 382-3, 396); XII (382-3) and XVIB; XII (396), XV (excl. 478) and XVIA, C; XIII; XIV; XXI (692) and XXXI; XXIIA; XXIIB, C, D; XXIII, XXIVB, and XXVI (889); XXIVA; XXV and XXVI (excl. 889); XXVII; XXVIII; XXIX; XXX; Class IV—I and II; III; IV, V, VII (excl. 241, 259) and XXI (693); VII (241) and XVII; VII (259), XXI (698) and XXXI (excl. 987); XII and XIII; XIV-XVI; XXIIA and XXIII; XXIIB, C, D and XXIV; XXVII; XXIX; XXX; Class V—II, III, XXVII, XXIX, and XXXI (963-4, 979); IV-XVI, XVIII-XXI and XXXI (970-1); XVII; XXII; XXIII.

[15] Excluded occupations by code number—000, 038, 077-9, 101, 110, 121, 141, 151, 164-6, 169, 281, 301, 321, 331, 341, 351-6, 359, 401, 431, 451, 461, 471, 501, 511, 521, 551, 561, 591, 601, 611, 631, 641, 650-1, 661, 681, 710, 715-6, 734, 751, 790, 795, 810-5, 821, 830, 840, 843, 861-2, 865, 912, 930, 961, 979, 987-8.

[16] 011 and 012 were combined; also 562, 931-3, and 939.

ANNOTATIONS

PROBLEMS OF DECLINING FERTILITY IN EUROPE

In 1935 Mr. D. V. Glass,[1] as Research Secretary of the British Population Investigation Committee, began a series of inquiries in the four European countries—Belgium, France, Germany, and Italy—in which measures had been adopted by the respective governments to check declining fertility. His object was to study and describe the nature of the measures and to consider the available evidence of their influence on reproductive trends. The results of his research were published in 1936 in his book, The Struggle for Population, which at once became the authoritative work on the subject. The measures described have since been considerably extended, Sweden has adopted a population policy, and in Denmark and Norway the question of taking similar action had before the war become one of national importance. In the present volume Mr. Glass brings his account of European population policies up to the outbreak of the war, introducing much additional matter, and includes a chapter on population movements in England and Wales, another devoted to a general discussion of the nature and consequences of population trends, and a statistical appendix in which are described with remarkable lucidity the most useful methods of measuring population growth. The result is an important contribution to the scientific study of population.

The measures adopted in Belgium, France, Germany, and Italy to promote marriage and parenthood fall broadly into three classes: (1) the use of propaganda to create a public opinion in favor of large families, (2) repressive measures aimed at discouraging individual control over reproduction, (3) the offer of material rewards for marriage and childbearing. The first class includes the issue of medals to parents of large families, newspaper publicity, and other marks of public approval. The second includes the prohibition of birth control propaganda and the sale

[1] Glass, D. V.: Population Policies and Movements in Europe. New York, Oxford University Press, 1940, 490 pp. $6.00.

of contraceptives, and the drastic penalizing of abortion induced on other than medical grounds; the imposition of special taxation and other disabilities upon unmarried persons may also be classed under this head. In the third class are such measures as family allowances, marriage loans, and the granting of taxation reliefs and other forms of material assistance to the parents of large families. Mr. Glass finds that though in all four countries birth control propaganda and the sale of contraceptives are illegal, the law, except in Germany, is not strictly enforced. The tendency is to rely less on repression and more on positive measures.

The most generally adopted of such measures is the granting of family allowances, the term family allowance being defined by Mr. Glass as "a cash grant, quite separate from and in addition to a man's wage or salary, given to help cover the costs of raising a family." The allowance usually varies in amount with the number of children and is given only in respect of dependent children. The family allowance system has been most fully developed in France and Belgium. In France the payment of family allowances began on a voluntary basis about the middle of the last century and was made compulsory in 1932; in Belgium the movement began later but developed more rapidly, and compulsion was applied in 1930. Because the payment of family allowances has been widely advocated as a means of checking the decline in the birth rate, it might be inferred that satisfactory evidence of their efficacy for this purpose is available. This, however, is not so. Figures have indeed been put forward. It has been shown that the birth rate among the employees of the French firms giving allowances is considerably higher than among the general population in the same locality or in France as a whole, but Mr. Glass shows that such comparisons, even with the adjustments that have been made in the attempt to eliminate differences in age composition, are invalid. He shows also that in France and Belgium the gross reproduction rate has since 1930 gone down more rapidly than in England, where there is no family allowance system. He admits that the French and Belgian population measures may have prevented an even more rapid fall, though he can find nothing to prove this, but he concludes that "they have not been influential enough to cause a rise in fertility, or even to stabilize fertility at its already low level of five or ten years ago." The Italian measures for checking the decline in fertility are more comprehensive, but they have not prevented a practically unbroken fall in the gross reproduction rate during the period from 1921-2 up to and in-

cluding 1936. Germany is the only country that has achieved any success in its attempts by governmental activity to bring more babies into the world. In 1939 the number of births reached replacement level.

Mr. Glass examines the various explanations put forward to account for the upward trend of the German marriage rate and birth rate since 1933, which he rightly regards as one of the most striking phenomena of recent years. Some writers attribute it to the material inducements given by the new régime to marriage and parenthood, others to the more drastic enforcement of the law against abortion and the suppression of birth control propaganda. In Germany it is attributed chiefly to what has been called the "spiritual rebirth" of the nation under the influence of the National Socialists. Mr. Glass subjects these various claims to critical analysis, and concludes "that the material measures have been more important than the 'psychic changes,' and that, in particular, the suppression of illegal abortion has been a major factor." This appraisal may usefully be considered together with the very different views expressed by Dr. Burgdörfer in VÖLKER AM ABGRUND, and in more recent writings.

The Swedish population policy differs from those so far considered in that it contains no measures of repression, such measures being regarded as inconsistent with democratic ideas; it is not desired to raise fertility by increasing the number of unwanted babies. But the development of the policy was checked at an early stage by the outbreak of the war, before the various measures had time to influence fertility.

Mr. Glass concludes that the European countries that have set out to raise fertility have little to show for the energy and money expended:

> But it is clear that the cash-and-kind grants have not, so far, been large enough to cover the additional costs of family life. Even in Sweden, where much time and intelligence has been spent in investigating and analysing—in seventeen reports—the many aspects of the population question, the economic assistance given to families is still very small. At the same time, pro-natalist propaganda has attacked the selfishness of childless married couples and of the parents of one- and two-child families, and has shown that such persons have a substantially higher standard of life, comparing similar income levels, than large families. It is therefore not surprising that the propaganda has largely failed, and that the repressive measures—which, with the apparent exception of Germany, are not in any case wholeheartedly enforced—should not be more conspicuously successful. The record of govern-

> mental attempts to stimulate fertility shows one significant and constant fact. However urgently governments may have declared their desire to increase the supply of births they have nevertheless persistently tried to buy babies at bargain prices.

Mr. Glass thinks, however, that something effective might be done to check declining fertility by "the provision of monetary grants which are large enough, when taken in bulk, to allow parents sufficiently to alter the present pattern of social life through the mechanism of effective demand."

The concluding chapter is devoted to a discussion of three questions:

> First, what is going to happen to the populations of the different countries? Secondly, will future trends have "good" or "bad" effects upon the economic and social life of the various countries? Thirdly, if the results are mainly bad, can we do anything now or in the future either to alter the trends or to minimize the disadvantages that they would otherwise bring in their train?

The outcome of the discussion is that in the present state of knowledge definite answers cannot be given to any of these questions, but the more important factors that have to be considered are indicated. Various estimates of future population trends are discussed, and the author includes three new estimates of his own, merely as "rough indications of possibilities," of the future population of England and Wales up to the year 2000, all of which show a considerable decline in the size of the population. These estimates, however, take no account of changes that may be brought about by the war. The difficulties that may be expected to arise in consequence of population decline are briefly considered, and the view taken is that they may be mitigated by economic and social planning, or even entirely avoided by increased freedom of immigration, and that a considerable period will elapse before the actual decline of numbers is likely to be serious. But the problem of raising the average number of children in the family to the level required for replacement is regarded as one of formidable difficulty; for "the population problem is not a single problem, but an aspect of all the social and economic problems by which the individual and the family are affected." It is an aspect on which new light is thrown by this book, which, well written and unfailingly interesting, embodies much painstaking research and critical acumen, and marks a real advance in the study of an important question.

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